A GUIDE TO THE GENERA OF MOSQUITOES (DIPTERA: CULICIDAE) OF THAILAND WITH ILLUSTRATED KEYS, BIOLOGICAL NOTES AND PRESERVATION AND MOUNTING TECHNIQUES

by

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CONTENTS

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INTRODUCTION

During the last 20 years, the taxonomy and ecology of the mosquito fauna of Thailand has received much attention from professional taxonomists. During this period there have been many publications in scientific journals on the description, distribution, bionomics and medical significance of a single genus, subgenus, species group or a species. However, local public health workers and students concerned with the study and/or control of the mosquitoes in Thailand have often not had access to these publications and have been forced to work without keys, or at best, with outdated keys to the genera of mosquitoes in Thailand. In fact, there is a great need within Thailand for more basic information, particularly keys, for the mosquito fauna of Thailand.

This publication has been prepared with the above needs in mind. The keys were prepared as simply as possible, using the most important characters. Hopefully, they will enable public health workers and students to quickly classify to genera, the adults, pupae, larvae and male genitalia of the mosquitoes of Thailand. In addition, references of particular importance for the identification of Thai mosquitoes have been included in Table 1.

A total of 18 genera and 41 subgenera of mosquitoes are recognized from Thailand, and listed (Table 2) with their most common immature habitats. All scientific names used herein follow Knight and Stone (23) and Knight (18).

Characters of both the adult and immature stages are very important for identification, in fact, some subgenera are best identified by characters of the immature stages. Accordingly, standard methods used at the AFRIMS for the preservation and mounting of immature and adult mosquito specimens have been included. Where possible, workers are encouraged to rear adults from the immature stages, preserving and mounting the 4th stage larval and/or the pupal exuviae as correlates of the adult. In this manner a "specimen" (adult, pupal and larval) can be identified by 3 keys or 4 if the adult is a male. If specimens that cannot be identified are encountered, the user is encouraged to submit these specimens to the Department of Medical Entomology, Armed Forces Research Institute of Medical Sciences (AFRIMS), Rajvithi Road, Bangkok.

MORPHOLOGY

The morphological characters used in the keys are illustrated for each couplet. Characters illustrated other than those referred to in the keys should not be used for identification. The terminology for the detailed characters of the female, male, male genitalia, pupa and larva follow Belkin (3), Reinert (44), Harbach and Knight (10), Knight (17) and Knight and Laffoon (20, 21, 22).

Since the morphological terminology for mosquitoes is extensive and may be confusing, some of the most commonly used morphological terms are

listed below, and where possible, defined according to Harbach and Knight (10).

AEDEAGUS - In most male mosquitoes, the central body of the phallosome serving as the intromittent organ.

ALVEOLUS - A cup-like depression (socket) bearing a seta or scale.

BASAL MESAL LOBE (BML) - In male mosquitoes, a small lobe or sclerite located basomesally on the gonocoxite; usually connected ventrally with its mate; possibly homologous with the claspette. (See PARABASAL LOBE).

CAUDAD - Posterior part of the body, away from the head.

CEPHALAD - Anterior part of the body, toward the head.

CHAETOTAXY - The study of the arrangement, branching and numbering of the setae on the exoskeleton of insects.

CUTICULAR PROJECTION - Any elongate process jutting from the outer surface of the cuticula. There are two basic types of cuticular projections: (1) SETAE, which are articulated processes arising from a basal alveolus, and (2) SPICULES, which are non-articulated, continuous processes of the cuticula.

EMARGINATE - Having a notched margin or tip.

FILAMENT - A long slender, flexible spicule which gradually tapers to a point or is of equal diameter throughout.

FRINGE - A border projecting from a margin, usually of fairly even length and composed of setae, spicules or scales.

MAXILLARY PALPUS - The teleopodite of the maxilla. In adult mosquitoes, inserted immediately below the clypeus and laterad to the base of the proboscis; varies widely in form according to genus and sex: primitively consisting of five palpomeres.

MESAD - Toward the midline of a bilaterally symmetrical body.

MICROTRICHIUM - One of the minute, slender, tapered, flexible spicules closely covering the wing membrane; characteristically bent so that they extend more or less parallel to the longitudinal veins with their apices pointed toward the wing margin.

OPISTHOPHALLAS (OP) - A transverse lobiform element of the phallosome located between the phallus and proctiger.

PARABASAL LOBE (PBL) - In male Anophelinae, a variably developed lobe located dorsobasally (prerotation sense) on the gonocoxite; bearing one or more strongly developed parabasal setae.

PHALLOSOME (PH) - In male mosquitoes, the complex structures surrounding the gonopore between the proctiger, gonocoxites and sternum IX; presumably consisting primitively of the basal pieces, parameres, prosophallus, phallus and opisthophallus, e.g., in *Aedes* subgenus *Verrallina;* usually comprised of the basal pieces, parameres and aedeagus, but including the lateral plates in *Culex;* the homologies of the various components are unknown.

PHALLUS (Ph) - The median lobe of phallosome located between the prosophallus and opisthophallus.

POSTTARSUS - The terminal segment of the arthopod leg distal to the tarsus.

PROCTIGER (Pr) - In insects with poorly defined segmentation behind the genital segments, the entire complex formed by the telson and the postgenital segments (abdominal segments X and XI). In such insects, the telson and abdominal segment XI are entirely membranous.

PROSOPHALLUS (PO) - A ventral lobelike element of the phallosome located between the bases of the gonocoxites.

PULVILLUS - One of two padlike or divided lobes on the posttarsus of some insects; one arising below the base of each unguis.

SCALE - A modified seta comprised of a slender basal stalk, pedicel, and an expanded and/or flattened distal part, squame; all scales have longitudinal ridges and arise from alveoli which are usually minute. Two main types of scales are recognized in mosquitoes by cross section of the squame. If the squame is round or elliptical, the scale is *piliform;* if it is thin and flat, the scale is *lamellar.* Many forms of lamellar scales exist but only one type of piliform scale.
Asymmetrical - A form of lamellar scale which is obviously unevenly developed on opposite sides of a plane which is parallel to the plane of the squame.

SERRATION - A recurved denticle-like process; a series of such processes is termed serrations.

SETA - A cuticular projection which arises from a basal alveolus.
Aciculate - Furnished with slender needlelike processes along the stem; the processes are somewhat flexible but often appear to be rigid.
Barbed - With minute, short, heavy, pointed processes projecting obliquely from the surface.
Bifid - Divided into two parts; forked.
Palmate - With flattened, movable, usually horizontal branches.
Stellate - Tufted; with numerous stiff branches projecting at various angles from a single base; branches may be simple, barbed or aciculate.

SPICULE - A non-articulated cuticular projection, directly continuous with the cuticula.

SPINE - A very large, sturdy, immovable spicule, with a sharp or narrowly rounded tip.

TRAGUS - A more or less elaborate lobe sometimes occurring on the rim of the pinna of a laticorn trumpet.

UNGUIS - An anterior or posterior claw of the arthropod posttarsus; either or both may be absent; usually both are present on the posttarsus of mosquitoes; referred to as fore-, mid- or hindungues as appropriate.

Abbreviations are used in the key when referring to the pupal and larval chaetotaxy of head, thorax and abdomen. Examples are as follows:

1-A = Seta 1 on the larval antenna
2-C = Seta 2 on the larval head
7-P = Seta 7 on the larval prothorax

1-S = Seta 1 on the larval siphon
4-X = Seta 4 on the larval abdominal segment X
1-Pa = Seta 1 on the pupal paddle

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NOTE

After the manuscript was submitted the following revision of *Paraedes* was published. This publication should serve as the primary reference for this subgenus.

Reinert, J. F. 1981. Med. Ent. Studies - XVI. A revision of the subgenus *Paraedes* of the genus *Aedes* (Diptera: Culicidae). Contrib. Amer. Entomol. Inst. (Ann Arbor). Vol. 18(4):1-91.

Table 1. List of genera, subgenera in Thailand (18,23) with their abbreviations (45) and primary references (including keys) to that genus in Thailand or Southeast Asia.

GENERA		SUBGENERA		PRIMARY REFERENCES
1. *Anopheles*	- *An*	*Anopheles*	- *Ano*	5, 12, 30, 35, 36, 37, 50
		Cellia	- *Cel*	5, 11, 34, 35, 36, 37, 50
2. *Aedeomyia*	- *Ad*	*Aedeomyia*	- *Ady*	2, 30, 56, 57
3. *Aedes*	- *Ae*	*Aedimorphus*	- *Adm*	2, 14, 30, 40
		Ayurakitia	- *Ayu*	39, 56
		Bothaella	- *Bot*	43
		Cancraedes	- *Can*	2, 26
		Christophersiomyia	- *Chr*	1, 2, 27
		Diceromyia	- *Dic*	2, 27, 38, 42
		Edwardsaedes	- *Edw*	46
		Finlaya	- *Fin*	2, 6, 16, 19
		Isoaedes	- *Isa*	49
		Lorrainea	- *Lor*	27
		Mucidus	- *Muc*	2, 28, 58
		Neomelaniconion	- *Neo*	2, 28
		Ochlerotatus	- *Och*	2, 28
		Paraedes	- *Par*	26, 48 (See note, p. 143)
		Rhinoskusea	- *Rhi*	2, 26, 47
		Stegomyia	- *Stg*	2, 13, 14, 15
		Verrallina	- *Ver*	2, 7, 8, 44
4. *Armigeres*	- *Ar*	*Armigeres*	- *Arm*	2, 30, 56
		Leicesteria	- *Lei*	2, 24, 56

GENERA		SUBGENERA		PRIMARY REFERENCES
5. *Heizmannia*	- *Hz*	*Heizmannia*	- *Hez*	2, 29, 30, 41
		Mattinglyi	- *Mat*	29, 41
6. *Udaya*	- *Ud*	-		30, 56
7. *Culex*	- *Cx*	*Culex*	- *Cux*	2, 4, 30, 53
		Culiciomyia	- *Cui*	4, 52, 55
		Eumelanomyia	- *Eum*	51
		Lophoceraomyia	- *Lop*	54
		Lutzia	- *Lut*	4
		Thaiomyia	- *Tha*	4
8. *Ficalbia*	- *Fi*	-		2, 25, 30
9. *Mimomyia*	- *Mi*	*Etorleptiomyia*	- *Eto*	2, 25, 30
		Mimomyia -	- *Mim*	2, 25
		Ingramia	- *Ing*	25, 60
10. *Hodgesia*	- *Ho*	-		2, 30, 56
11. *Coquillettidia*	- *Cq*	*Coquillettidia*	- *Coq*	2, 30, 59
12. *Mansonia*	- *Ma*	*Mansonioides*	- *Man*	2, 30, 59
13. *Orthopodomyia*	- *Or*	-		2, 30, 61
14. *Malaya*	- *Ml*	-		2, 30, 56
15. *Topomyia*	- *To*	*Topomyia*	- *Top*	2, 30, 56
		Suaymyia	- *Sua*	56
16. *Tripteroides*	- *Tp*	*Tripteroides*	- *Trp*	2, 9, 30, 31, 56
17. *Uranotaenia*	- *Ur*	*Pseudoficalbia*	- *Pfc*	2, 30, 32, 33
		Uranotaenia	- *Ura*	2, 32
18. *Toxorhynchites*	- *Tx*	*Toxorhynchites*	- *Tox*	2, 30, 56

Table 2. Basic (Common) Immature Habitats for Mosquito Genera and Subgenera in Thailand.

Genera and Subgenera	Pond-Lake	Ground Pool	Swamp-Open	Marshy Depression	Stream Margin	Stream Pool	Rock Pool	Rock Hole	Seepage-Spring	Flood-Pool	Ditch	Pit	Hollow Log	Well	Grassy Pool	Puddle	Salt Marsh	Crab Hole	Foot-Print Wheel Track	Elephant Foot-Print	Rice Paddy	Artificial Container	Tree Hole	Stump Hole	Bamboo Internode	Bamboo Stump	Bamboo Split	Alocasia Colocasia Axil	Mangrove Swamp/Tree Hole	Pandanus Axil	Ginger Axil	Pineapple Axil	Pitcher Plant	Banana Tree or Axil	Nipa Axil	Coconut Shell	Coconut Husk	Leaf Axil	Fallen Leaf, Frond, etc.
Anopheles Meigen																																									
(Anopheles)	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	-	-	x	-	-	-	-	-	-	-	-	-	-
(Cellia)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aedeomyia Theobald																																								
(Aedeomyia)	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aedes Meigen																																								
(Aedimorphus)	-	x	x	-	-	-	-	-	x	x	x	x	-	x	x	x	-	-	x	x	x	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Ayurakitia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Bothaella)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Cancraedes)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Christophersiomyia)	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	x	-	-	-	-	x	x	-	x	x	x	x	x	-	-	-	-	-	-	-	-	-	-
(Diceromyia)	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-
(Edwardsaedes)	-	x	-	-	-	-	-	-	x	x	-	-	-	-	-	-	x	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Finlaya)	-	-	-	-	-	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
(Isoaedes)	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Lorrainea)	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	x	-	-	-	x	x	-	-	-	x	x	x	x	x	-	-	-	-	-	-	-	-	-
(Mucidus)	-	x	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Neomelaniconion)	-	x	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Ochlerotatus)	x	x	-	-	-	-	x	-	-	x	-	-	-	x	x	-	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paraedes)	-	x	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Rhinoskusea)	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Stegomyia)	-	-	-	-	-	-	x	x	-	-	-	-	x	-	-	x	-	-	-	-	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
(Verrallina)	-	-	-	-	x	x	x	-	x	x	x	x	x	x	-	x	x	x	x	x	-	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Armigeres Theobald																																								
(Armigeres)	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	x	x	-	x	x	x	x	x	-	-	-	-	-	-	-	-	-	-
(Leicesteria)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-
Heizmannia Ludlow																																								
(Heizmannia)	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	x	-	-	x	x	x	-	-	-	-	x	-	-	-	-	-	-	-
(Mattinglyia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2. (Continued)

Genera and Subgenera	Pond-Lake	Ground Pool	Swamp-Open	Marshy Depression	Stream Margin	Stream Pool	Rock Pool	Rock Hole	Seepage Spring	Flood-Pool	Ditch	Pit	Hollow Log	Well	Grassy Pool	Puddle	Salt Marsh	Crab Hole	Foot-Print Wheel Track	Elephant Foot-Print	Rice Paddy	Artificial Contained	Tree Hole	Stump Hole	Bamboo Internode	Bamboo Stump	Bamboo Split	Alocasia Colocasia Axils	Mangrove Swamp/Tree Hole	Pandanus Axil	Ginger Axil	Pineapple Axil	Pitcher Plant	Banana Tree or Axil	Nipa Axil	Coconut Shell	Coconut Husk	Leaf Axil	Fallen Leaf Frond, etc.
Udaya Thurman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-
Culex Linnaeus	-	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-
(Culex)	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	-	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Culiciomyia)	-	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	-	-	x	x	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Eumelanomyia)	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x	-	-	x	-	x	x	x	x	-	-	x	-	-	x	-	x	-	-	-	-
(Lophoceraomyia)	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	x	-	x	-	-	-	-
(Lutzia)	-	-	-	-	-	x	x	-	-	x	x	x	x	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Thaiomyia)	-	x	x	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficalbia Theobald	-	x	x	x	x	x	x	-	x	-	-	-	-	x	x	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mimomyia Theobald	-	x	x	x	x	x	x	-	x	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Etorleptiomyia)	-	x	x	x	x	x	x	-	x	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Mimomyia)	-	x	x	x	x	x	x	-	x	-	-	-	-	x	x	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Ingramia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hodgesia Theobald	-	x	x	-	x	x	x	-	x	x	-	-	-	-	x	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coquillettidia Dyar	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Coquillettidia)	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mansonia Blanchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Mansonioides)	x	-	x	-	-	x	-	-	-	-	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthopodomyia Theobald	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malaya Leicester	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Topomyia Leicester	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Topomyia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Suaymyia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tripteroides Giles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Tripteroides)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranotaenia Lynch Arribalzaga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pseudoficalbia)	x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	-	-	x	x	x	-	x	x	x	x	x	x	-	-	x	-	-	x	-	x	-	x	-	-
(Uranotaenia)	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	-	-	x	x	x	-	x	x	x	x	x	x	-	-	x	-	-	x	-	x	-	x	-	-
Toxorhynchites Theobald	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	x	x	x	x	x	x	-	-	x	-	-	x	-	x	x	-	-	-
(Toxorhynchites)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PRESERVATION AND MOUNTING TECHNIQUES FOR MOSQUITOES

1. WHOLE LARVAE

1. Kill larvae in hot water (not boiling), remove promptly.
2. Store in small vial containing 75-80% ethanol (ethyl alcohol).
3. Transfer specimens from alcohol to cellosolve for 15 minutes or more (dark specimens can be stored in cellosolve for 8 hours or overnight).
4. Lift the specimen from cellosolve* and place on the center of glass microscope slide with the dorsal side up.
5. Drop a small amount of Canada balsam** on specimen. Mount specimen dorsal side up with the head pointing down, arrange head, thorax and abdomen in natural position, then cut the abdomen between segment VI and VII (using surgical blade No. 25). Place the terminal segments with siphon to the left in culicine larvae or segment X to the right in anopheline larvae. (See Plate I).
6. Add more Canada balsam on specimen and check the arrangement of setae and larval position, then carefully cover specimen with a 22 mm rectangular cover glass.
7. Dry in drying oven at 45°-55°C for 2 weeks or more.

2. WHOLE PUPAE

1. Follow steps 1-5 described for mounting whole larvae.
2. Separate cephalothorax from the metanotum and abdomen. Mount specimen pointing down, place metanotum and abdomen dorsal side up then turn cephalothorax left side up and place below the metanotum. (See Plate I).
3. Add more Canada balsam on specimen, check specimen for correct position. Cover specimen with a 15 mm round cover glass.
4. Dry in drying oven at 45°-55°C for 2 weeks or more.

3. LARVAL AND PUPAL EXUVIAE

The 4th larval and pupal exuviae from an individually reared adult should be mounted on the same slide.

1. Store in 75-80% alcohol.
2. Transfer specimens into cellosolve for 15 minutes.
3. Lift the specimen from cellosolve placing it on a glass microscope slide, the larval exuvia on the left and pupal exuvia on the right (pointing head down and dorsal side up).
4. Drop a small amount of Canada balsam on specimens. Arrange and spread body and setae of larval exuvia into better position, then separate the

---

*Dilute cellosolve may turn white when adding Canada balsam on specimen. To avoid this problem, use facial tissue to blot off the excess cellosolve from the specimen before adding Canada balsam on specimen. (Touch specimen carefully and softly with small piece of facial tissue).

**Euparal can be used instead of Canada balsam. Thick Canada balsam can be thinned down with xylene and Euparal with Euparal essence.

pupal cephalothorax just cephalad of wing sheath, leave metanotum attached to abdomen. Open the cephalothorax and mount the ventral side up, place below metanotum. (See Plate I).

5. Add more Canada balsam, check position of larval and pupal exuviae then cover specimens with a 15 mm round cover glass.

6. Dry in drying oven at 45°-55°C for 2 weeks or more.

4. ADULTS

1. After emergence, adults should be held for at least 24 hours before killing. Dried specimens should be relaxed in a relaxing jar for at least 2 hours so that the appendages will not break when handled.

2. Kill in chloroform* killing bottle. (Ethyl acetate keeps specimens relaxed longer).

3. Using a small amount of "Ambroid" cement** on tip of paper point, glue specimen on the right side of thorax with legs toward pin, wing and body should not be attached with paper point and glue, and point should not project beyond scutum. (See label, Plate I).

4. Pinned specimens should be kept in Schmitt boxes. Paradichlorobenzene* or napthalene* is needed for each box to protect specimens from being eaten by beetles, cockroaches, mites and other insects. The former has both repellent and insecticidal properties but does not last as long as the latter which basically acts as a repellent.

5. GENITALIA

1. Place adult in relaxing jar for 3-5 hours*** (Can use a jar with boiling-steaming water for 20-30 minutes).

2. Clip abdomen between 6th and 7th segments using a fine dissecting scissors.

3. Place the genitalia in a small screw cap vial containing 10% KOH**** and a small drop of 40% detergent to sink the genitalia in the KOH.

4. Put the vial in a beaker of boiling water (but do not boil contents in vial), or leave the vial in drying oven at 45°-55°C for 1 hour.

5. Transfer the genitalia to cellosolve for 10-15 minutes.

6. Place the specimen on the center of a glass microscope slide. Dissection of the genitalia should be made in cellosolve. Dissect the genitalia from the 7th and 8th abdominal segments and place below the segments, tergal side up with the gonostylus pointing down. (See Plate I).

7. Position each piece of the genitalia in a minute drop of Canada balsam. Dry slide in oven overnight.

---

*CAUTION! Chloroform and Ethyl Acetate are toxic and dangerous to breathe. These chemicals are stored in liver tissues and may cause health problems if used frequently. Always use in well ventilated areas.

**"Ambroid" cement should be thinned down with amyl acetate.

***Specimens are normally mounted on points or pinned before this procedure.

****Potassium hydroxide.

8. Add more Canada basam over specimen and place 2-3 tiny pieces of broken cover glass surrounding the specimen and cover with a 12 mm round cover glass.

9. Dry in drying oven at 45°-55°C for 2 weeks or more.

6. STAINING GENITALIA

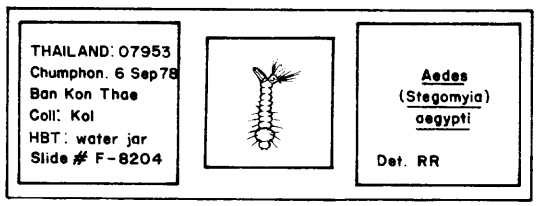
1. Follow genitalia mounting techniques steps 1-4.
2. Remove and place genitalia in 5% acetic acid and 1-2 drops of acid fuchsin solution* overnight or leave in the oven for another hour.
3. Remove and place in cellosolve (can be stored in this).
4. Follow genitalia mounting techniques.

7. LABELING (Plate I)

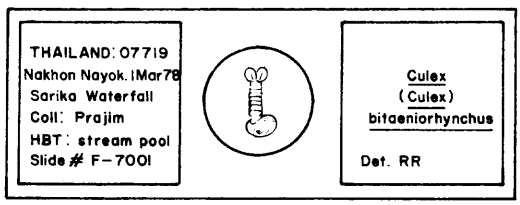
1. Label the slide with 2 labels:
   a. *Left label contains:*
      1. Country, collection number
      2. Province, date collected
      3. Location
      4. Collector's name
      5. Habitat
      6. Slide number
   b. *Right label contains:*
      1. Genus
      2. Subgenus
      3. Species
      4. Person making determination
2. Label the adult with 2 labels. Each label should be 1/4" x 1/2" in size or smaller.
   a. *Upper label contains:*
      1. Country, province
      2. Location
      3. Collection Number
      4. Date/Year
   b. *Lower label contains:*
      1. Genus, subgenus and species
      2. Sex
      3. Person making determination

*Acid fuchsin solution:

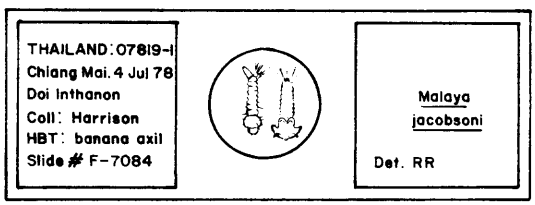
acid fuchsin	-	.05 gm.
10% hydrochloric acid	-	25 cc.
distilled water	-	300 cc.



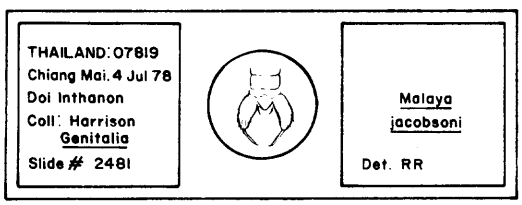
LARVA



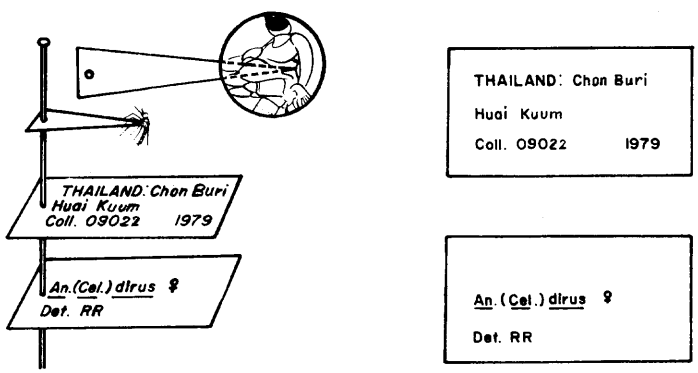
PUPA



LARVAL AND PUPAL EXUVIAE



GENITALIA



ADULT

PLATE I

ADULT MORPHOLOGY

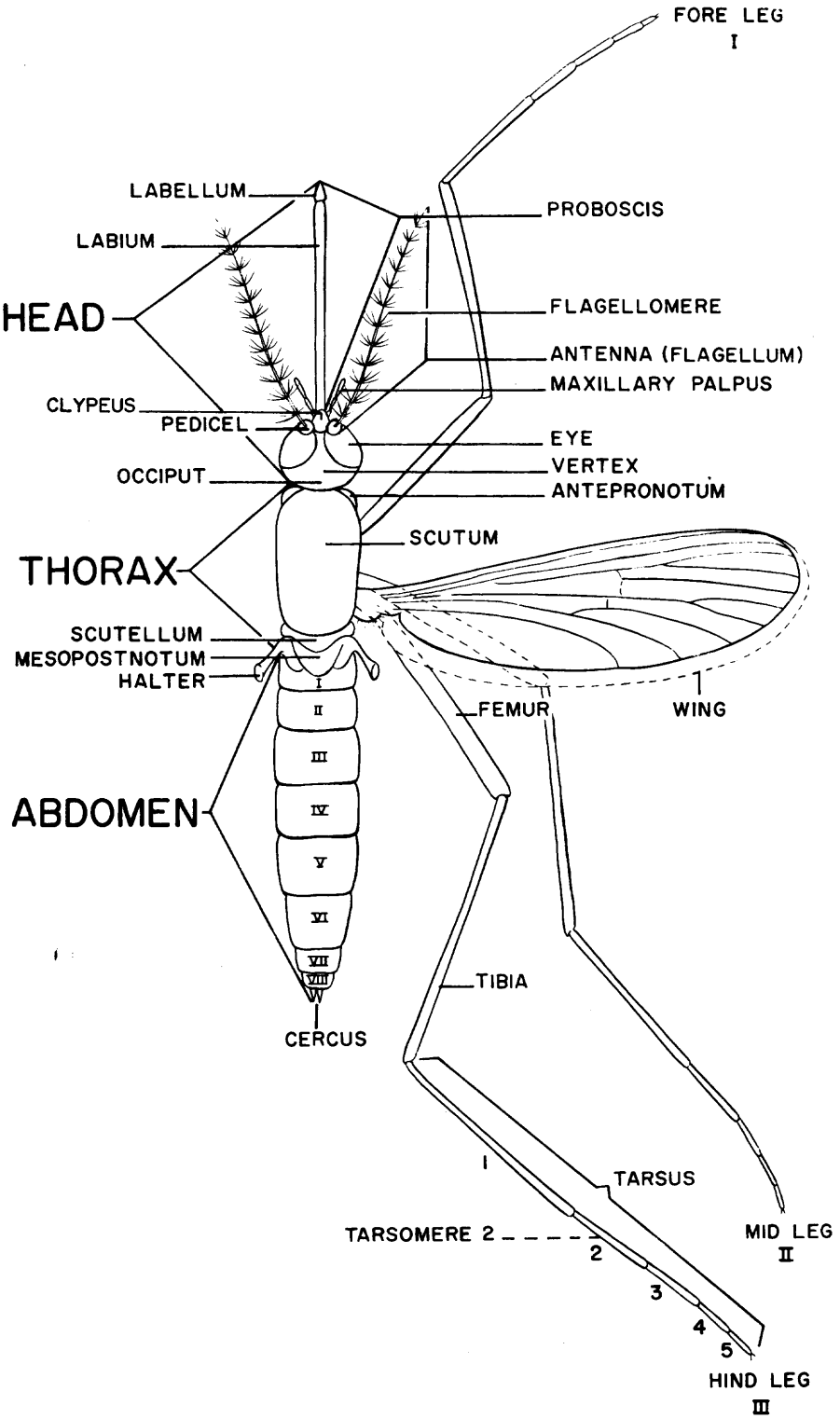
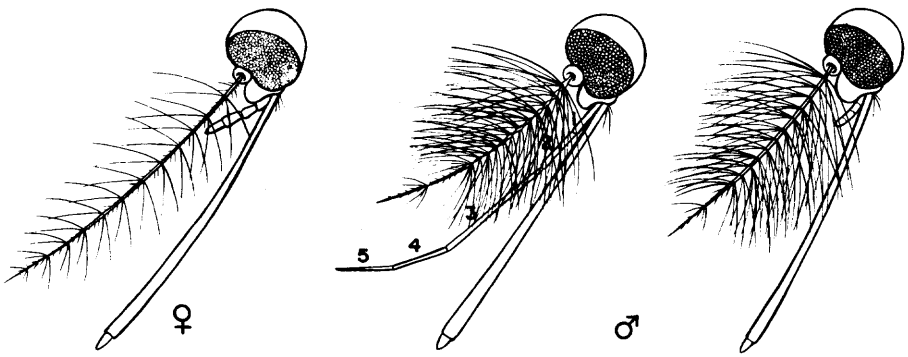
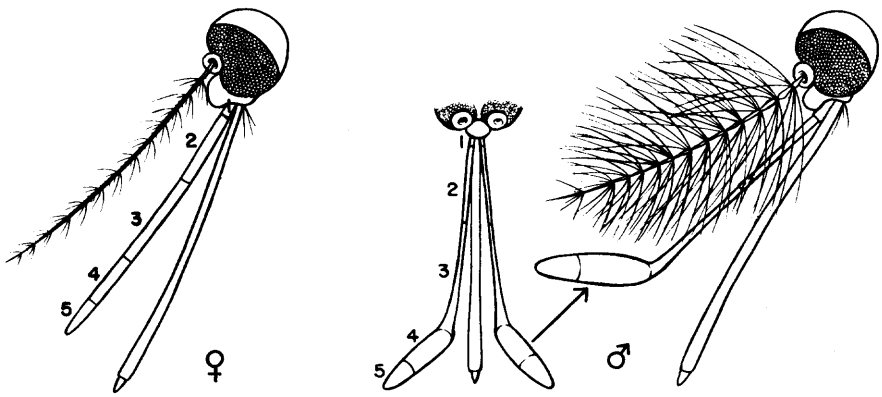


PLATE II

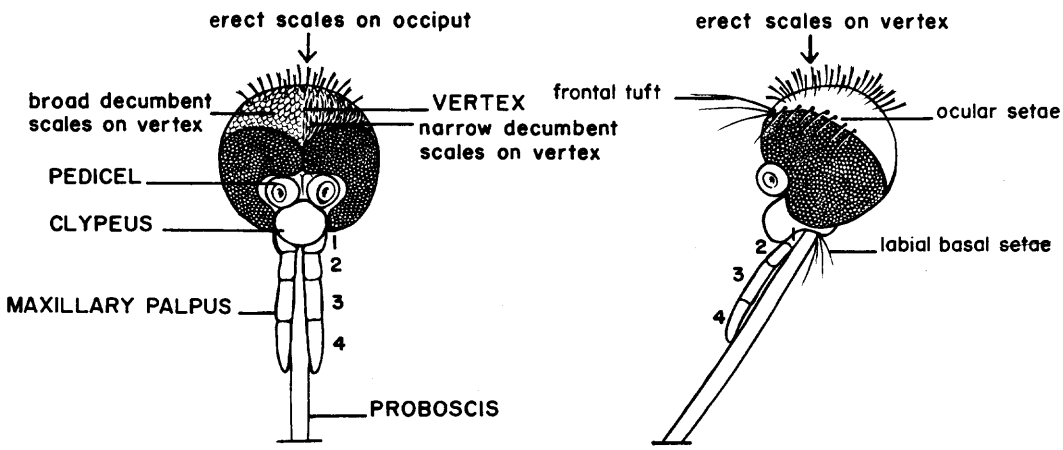
HEAD



CULICINAE



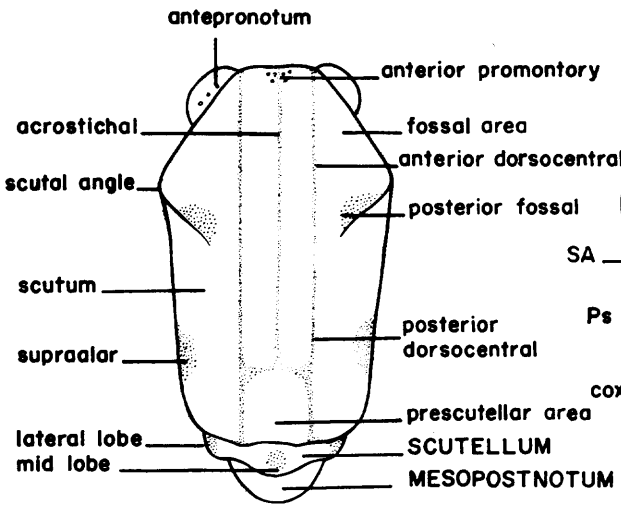
ANOPHELINAE



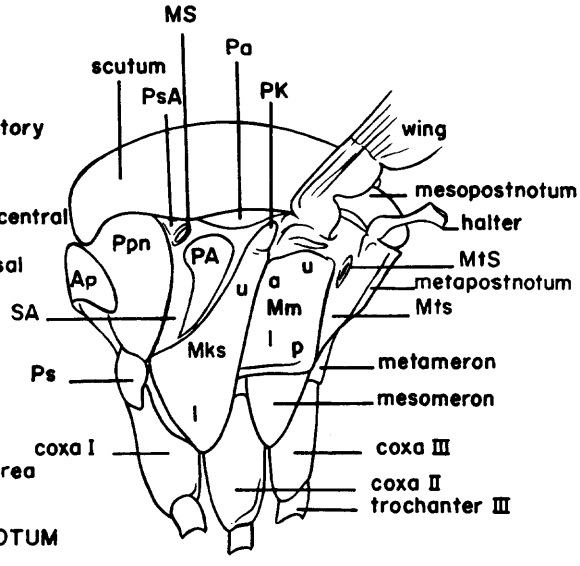
ANTERIOR ASPECT LATERAL ASPECT

PLATE III

THORAX

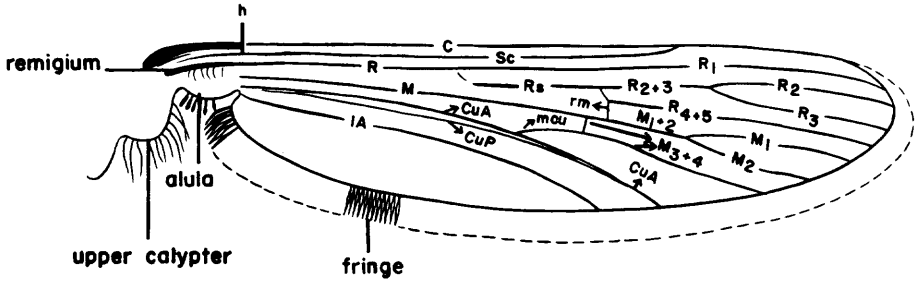


DORSAL ASPECT



LATERAL ASPECT

WING



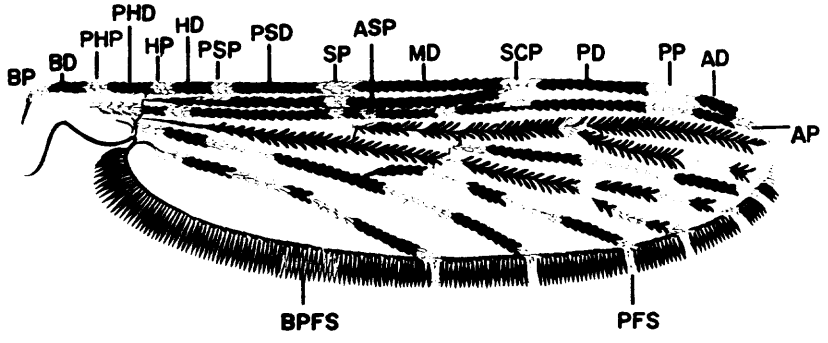


PLATE IV

ABBREVIATIONS
(Plate IV)
ADULT

THORAX

Ap = anteprontotum
Mm = mesepimeron
Mks = mesokatepisternum
MS = mesothoracic spiracle
Mts = metepisternum
MtS = metathoracic spiracle
Pa = paratergite
PA = postspiracular area
PK = prealar knob
Ppn = postpronotum
Ps = proepisternum
PsA = prespiracular area
SA = subspiracular area
u = upper
l = lower
a = anterior
p = posterior

WING SPOTS

AD = apical dark
AP = apical pale
ASP = accessory sector pale
BD = basal dark
BP = basal pale
BPFS = basal pale fringe spot
h = humeral
HD = humeral dark
HP = humeral pale
MD = middle dark
PD = preapical dark
PFS = pale fringe spot
PHD = prehumeral dark
PHP = prehumeral pale
PP = preapical pale
PSD = presector dark
PSP = presector pale
SCP = subcostal pale
SP = sector pale

WING VEINS

C = costa
CuA = cubitus anterior
CuP = cubitus posterior
M = media
M_1, M_2, M_{1+2}, M_{3+4} = branches of media
mcu = mediocubital crossvein
R = radius
R_1, R_2, R_3, R_{2+3}, R_{4+5} = branches of radius
rm = radiomedial crossvein
Rs = radial sector
Sc = subcosta
1A = anal vein

MALE GENITALIA

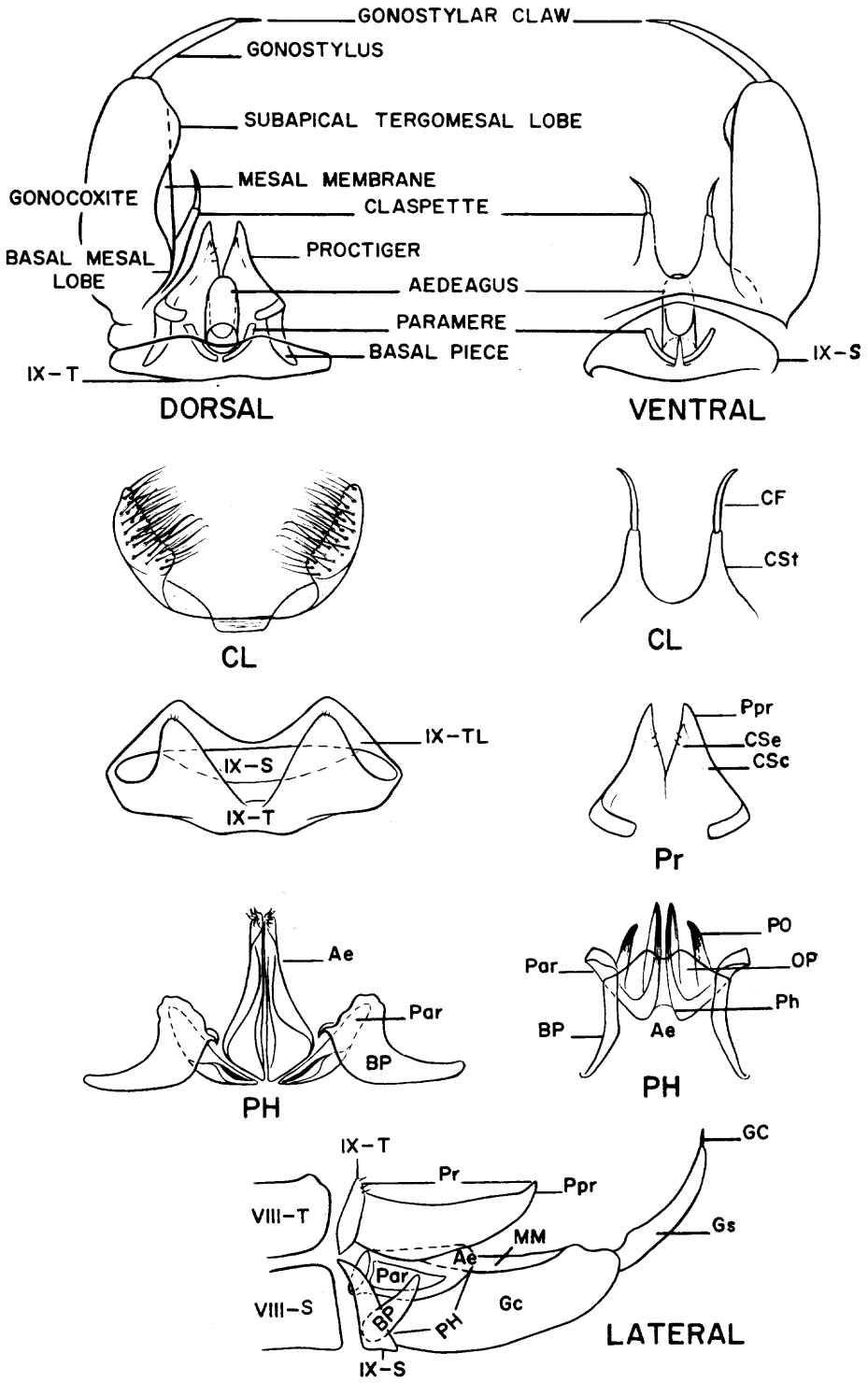


PLATE V

ABBREVIATIONS

(Plate V)

MALE GENITALIA

Ae	=	aedeagus	MM	=	mesal membrane
BML	=	basal mesal lobe	OP	=	opisthophallus
BP	=	basal piece	Par	=	paramere
CF	=	claspette filament	Ph	=	phallus
Cl	=	claspette	PH	=	phallosome
CSc	=	cercal sclerite	PO	=	prosophallus
Cse	=	cercal setae	Ppr	=	paraproct
CSt	=	claspette stem	Pr	=	proctiger
Gc	=	gonocoxite	IX-T	=	ninth tergum
GC	=	gonostylar claw	IX-TL	=	ninth tergal lobe
Gs	=	gonostylus	IX-S	=	ninth sternum

PUPA

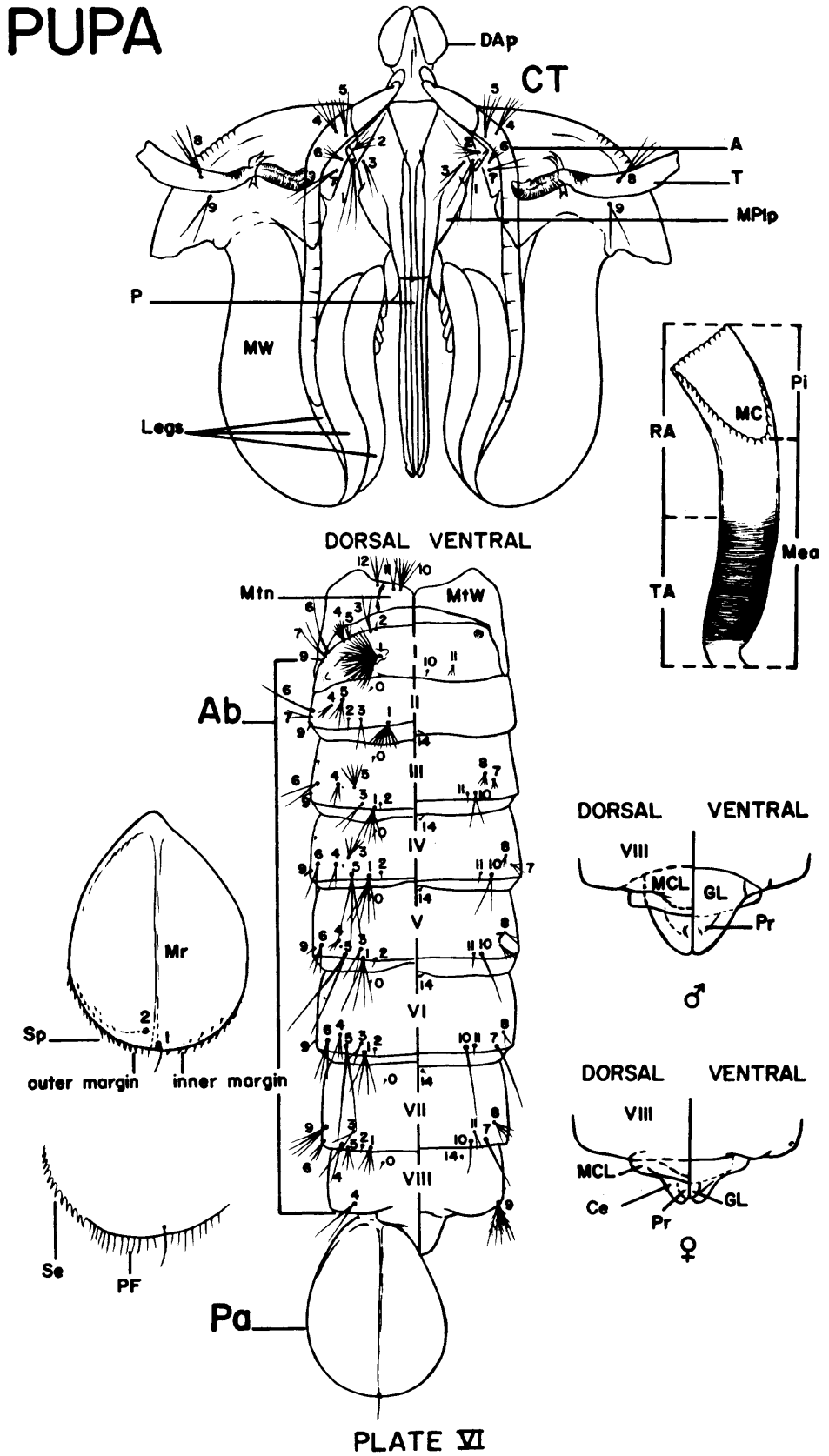


PLATE VI

ABBREVIATIONS
(Plate VI)
PUPA

A	=	antenna	MtW	=	metathoracic wing
Ab	=	abdominal segment	MW	=	mesothoracic wing
Ce	=	cercus	P	=	proboscis
CT	=	cephalothorax	Pa	=	paddle
DAp	=	dorsal apotome	PF	=	paddle fringe
GL	=	genital lobe	Pi	=	pinna
MC	=	meatal cleft	Pr	=	proctiger
MCL	=	median caudal lobe (IX)	RA	=	recticulate area
Mea	=	meatus	Se	=	paddle marginal serrations
MPlp	=	maxillary palpus	Sp	=	paddle marginal spicules
Mr	=	midrib	T	=	trumpet
Mtn	=	metanotum	TA	=	tracheoid area

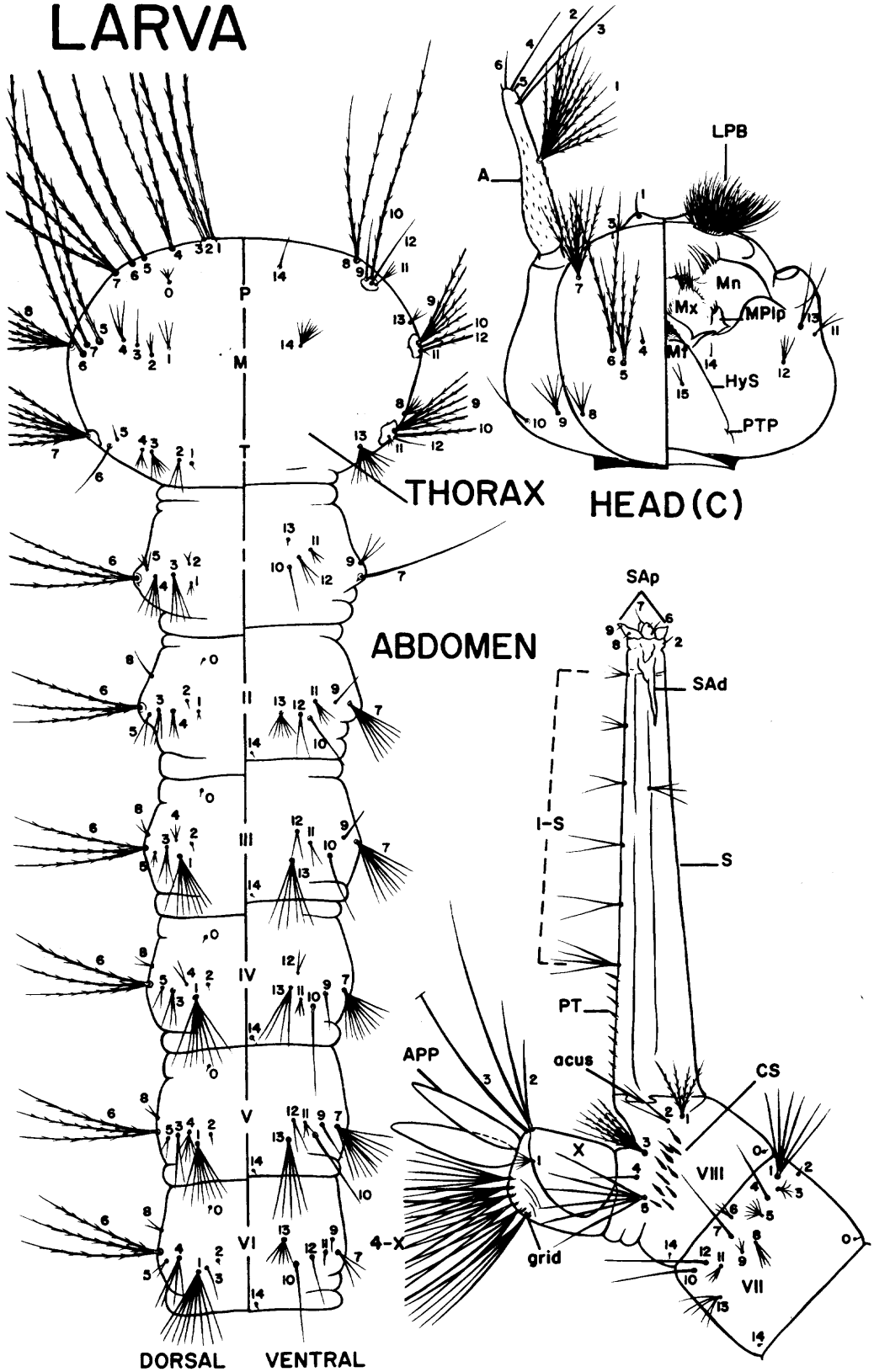

LARVA
P
M
T
THORAX
HEAD(C)
LPB
A
Mn
Mx
MPlp
Mt
HyS
PTP
ABDOMEN
SAp
SAd
I-S
S
PT
APP
acus
CS
X
VIII
4-X
grid
VII
DORSAL
VENTRAL

PLATE VII

ABBREVIATIONS
(Plate VII)
LARVA

A = antenna
APP = anal papilla
C = cranium or head capsule
CS = comb scale
HyS = hypostomal suture
LPB = lateral palatal brush
M = mesothorax
Mn = mandible
MPlp = maxillary palpus
Mt = mentum
Mx = maxilla
P = prothorax
PT = pecten
PTP = posterior tentorial pit
S = siphon
SAd = spiracular apodeme
SAp = spiracular apparatus
T = metathorax
4-X = ventral brush

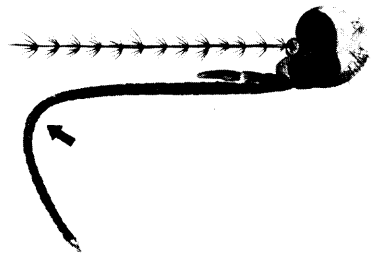
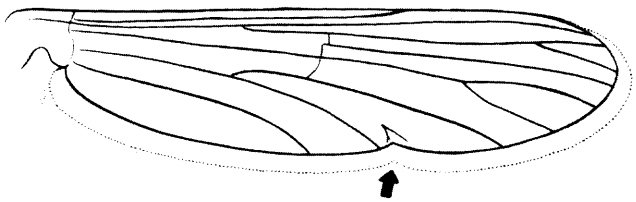


Fig. 1a



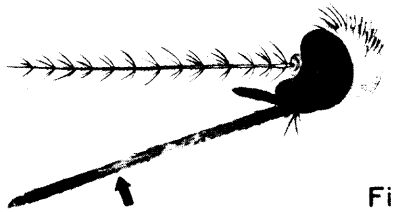
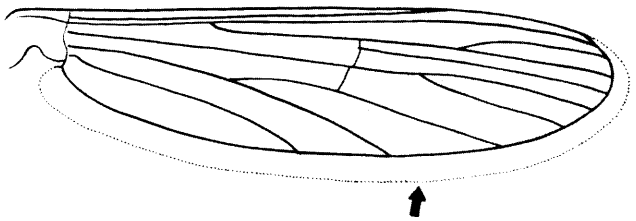


Fig. 1b



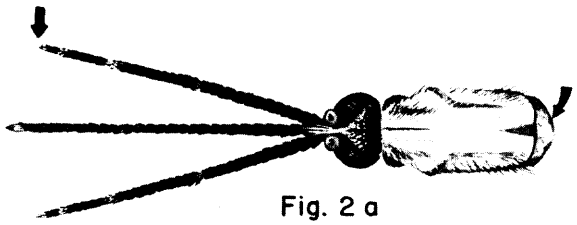


Fig. 2a

Fig. 2b

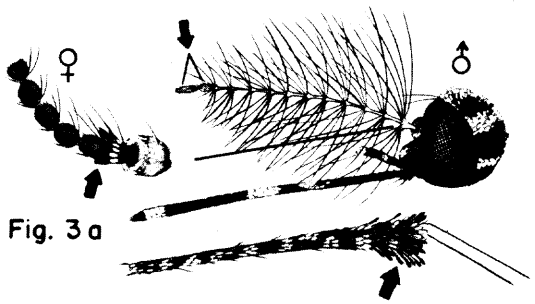


Fig. 3a

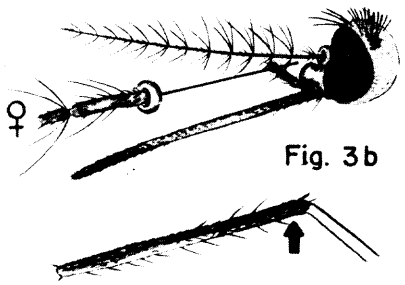


Fig. 3b

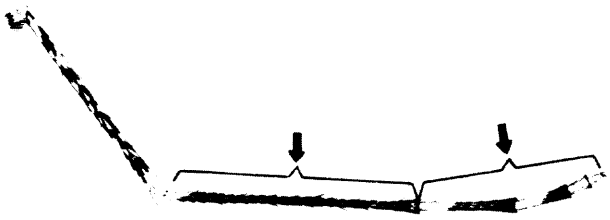


Fig. 4a

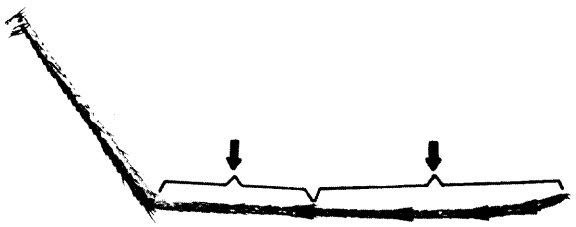


Fig. 4b

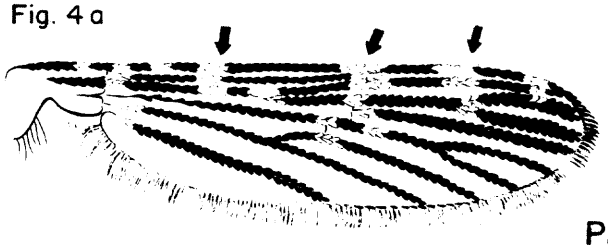


PLATE VIII

KEY TO GENERA OF MOSQUITOES

ADULT

1. Apical half of proboscis attenuated and sharply curved downward; wing with posterior edge emarginated just beyond tip of vein CuA (Fig. 1a); large or very large, brightly colored mosquitoes ..... *Toxorhynchites*

   Proboscis and wing otherwise (Fig. 1b)..... 2

2(1). Scutellum evenly rounded; *Female* palpus approximately equal length of proboscis (Fig. 2a)..... *Anopheles*

   Scutellum trilobed; *Female* palpus short, not more than 0.7 length of proboscis (Fig. 2b)..... 3

3(2). Mid and hindfemora with large tuft of sub-erect scales at apex; *Female* antennal flagellomeres short and thick, basal flagellomere with prominent scale tuft; *Male* antenna with the 2 terminal flagellomeres markedly thickened (Fig. 3a) .... *Aedeomyia catasticta*

   (only single species in Thailand)

   Femora and antenna otherwise (Fig. 3b) 4

4(3). Fore and midtarsomeres 1 distinctly longer than tarsomeres 2-5 together; wing spotted, as in many species of *Anopheles* (Fig. 4a) ..... *Orthopodomyia*

   Fore and midtarsomeres 1 not distinctly longer than tarsomeres 2-5 together; wing not spotted, except *Culex (Culex) mimeticus* subgroup, *Aedes (Finlaya) kochi* group and some species of *Uranotaenia* (Fig. 4b)..... 5

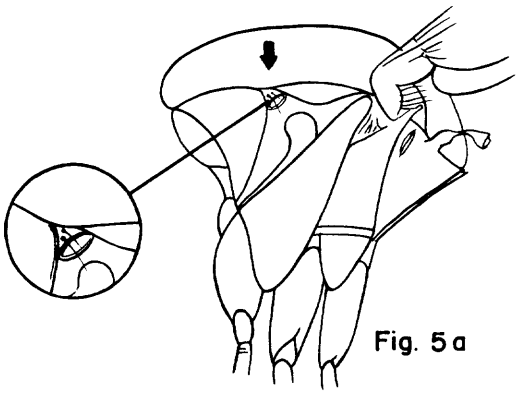


Fig. 5a

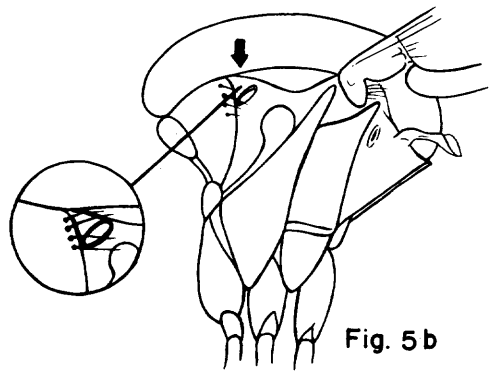


Fig. 5b

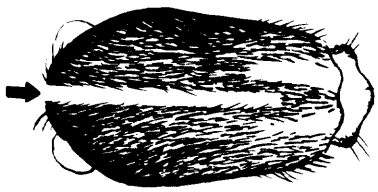


Fig. 6 a

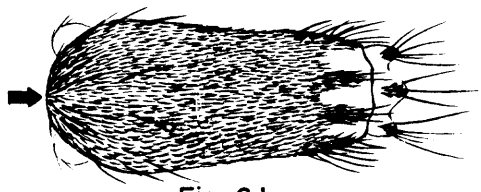


Fig. 6 b

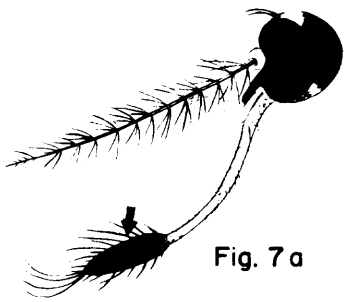


Fig. 7a

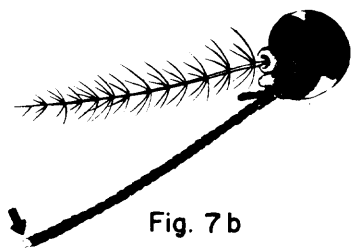


Fig. 7b

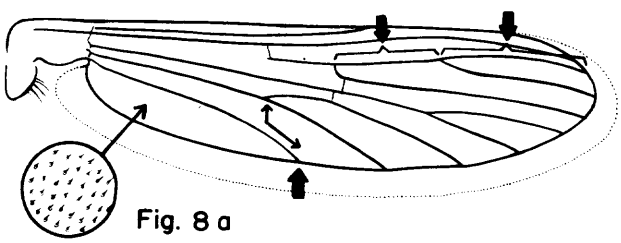


Fig. 8 a

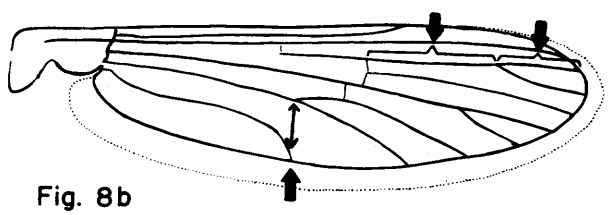


Fig. 8b

PLATE IX

5(4). Prespiracular setae present* (Fig. 5a) 6

Prespiracular setae absent (Fig. 5b) 9

6(5). Scutum with conspicuous median longitudinal line of broad scales, usually white or silver scales (Fig. 6a) 7

Scutum without conspicuous median longitudinal line of broad scales (Fig. 6b) 8

7(6). Proboscis swollen apically, upturned and hairy (Fig. 7a) .... *Malaya*

Proboscis slender, if slightly swollen then not upturned and hairy (Fig. 7b) ..... *Topomyia*

8(6). Wing membrane with distinct microtrichia; vein 1A reaching wing margin well beyond base of vein mcu; vein R_2 longer than vein R_{2+3} (Fig. 8a) ..... *Tripteroides*

Wing membrane with indistinct microtrichia, visible only under very high magnification; vein 1A reaching wing margin before, or at most very slightly beyond base of vein mcu; vein R_2 shorter than vein R_{2+3} (Fig. 8b) ..... *Uranotaenia*

*Not to be confused with marginal setae on postpronotum as shown in Fig. 5b.

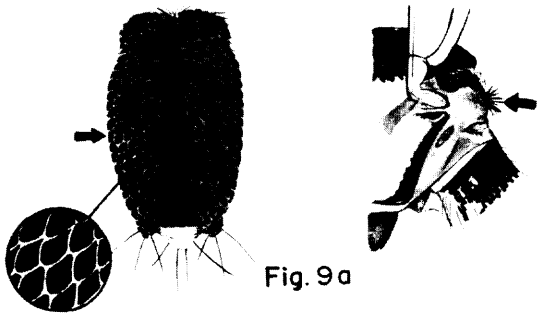


Fig. 9a

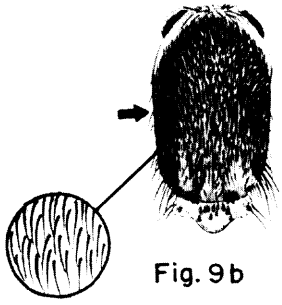


Fig. 9b

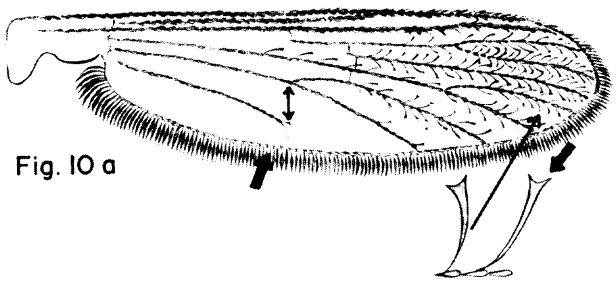


Fig. 10a

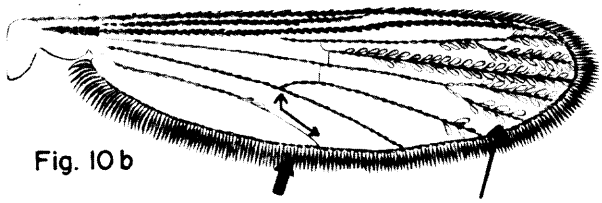


Fig. 10b

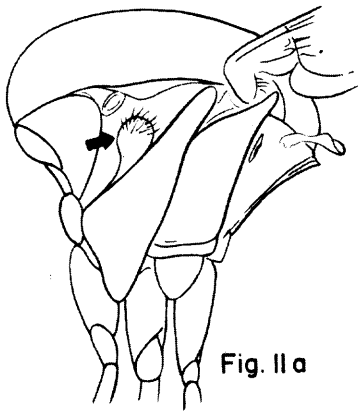


Fig. 11a

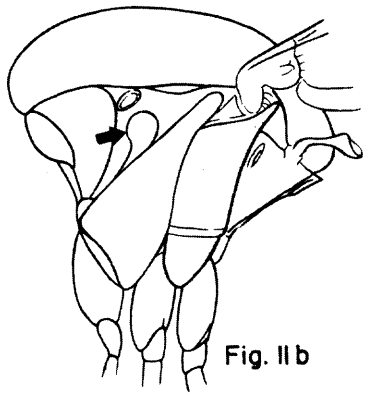


Fig. 11b

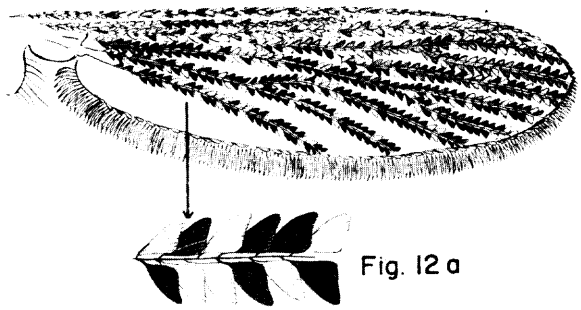


Fig. 12a

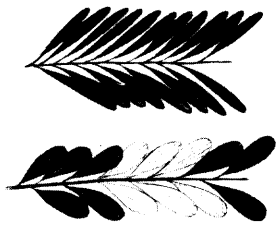


Fig. 12b

PLATE X

9(5). Scutum covered with bright metallic, broad flat scales or mesopostnotum with group of small setae, usually both (Fig. 9a) ..... *Heizmannia*

Scutum largely covered with narrow scales; mesopostnotum bare except *Armigeres (Leicesteria) flavus* (Fig. 9b) 10

10(9). Outstanding scales on outer half of wing field with emarginated tips; vein 1A reaching wing margin before, or at most, very slightly beyond base of vein mcu (Fig. 10a) ..... *Hodgesia*

Outstanding scales on outer half of wing field without emarginated tips; vein 1A reaching wing margin well beyond base of vein mcu, except *Aedes* subgenus *Cancraedes* (Figs. 10b, 12a, b) 11

11(10). Postspiracular setae present (Fig. 11a) 12

Postspiracular setae absent* (Fig. 11b) 15

12(11). Dorsal scales on wing veins mostly broad and strongly asymmetrical; dark and white scales intermixed (Fig. 12a) .... *Mansonia* subgenus *Mansonioides*

Dorsal scales on wing veins not broad, or if broad, then not strongly asymmetrical; scales usually dark, except *Aedes (Finlaya) kochi* group (Fig. 12b) 13

*Setae may not be visible due to scales [e.g., *Aedes (Stegomyia)*].

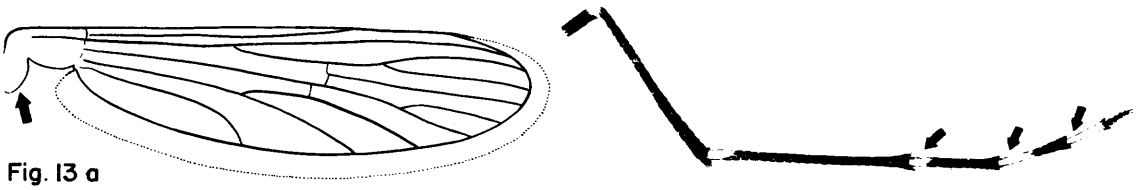


Fig. 13 a

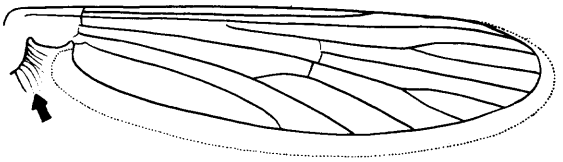


Fig. 13 b

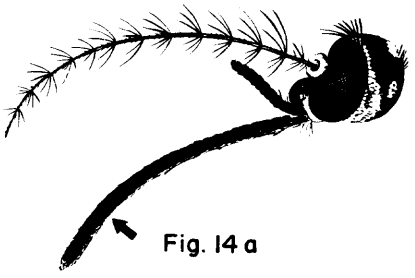


Fig. 14 a

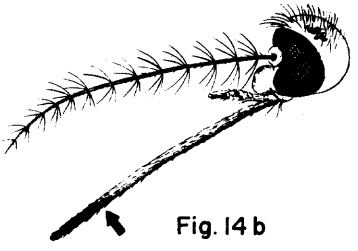
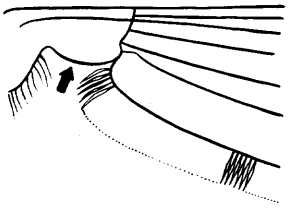


Fig. 14 b



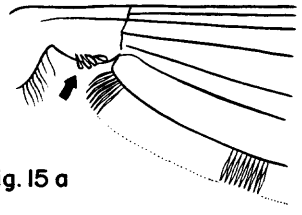


Fig. 15 a

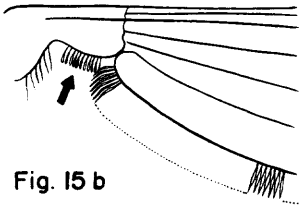


Fig. 15 b

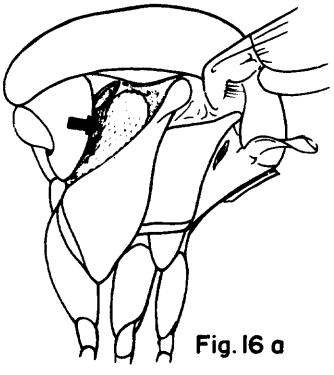


Fig. 16 a

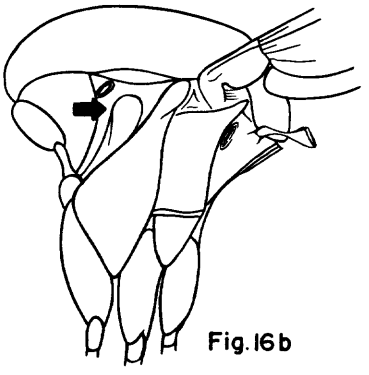


Fig. 16 b

PLATE XI

13(12). Upper calypter bare or with few short setae*; hindtarsomeres 2-4 with conspicuous white basal bands (Fig. 13a); yellow-brown mosquitoes with conspicuous silver ornamentation ... . *Udaya argyrurus*

(only single species in Thailand)

Upper calypter with long fringe; hindtarsomeres 2-4 with or without white basal bands (Fig. 13b); color or ornamentation otherwise 14

14(13). Proboscis gradually curved downward and laterally compressed (Fig. 14a); large mosquitoes .... *Armigeres* subgenus *Armigeres*

Proboscis not curved downward or if slightly so, not laterally compressed (Fig. 14b); small or medium sized mosquitoes .. .. *Aedes* (in part)

15(11). Alula bare or with broad, flat, decumbent scales (Fig. 15a) .... *Mimomyia*

Alula with narrow or moderately broad erect fringe scales (Fig. 15b) 16

16(15). Postspiracular area covered with broad scales (Fig. 16a) .. 17

Postspiracular area without scales (Fig. 16b) 18

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*These setae are easily rubbed off.

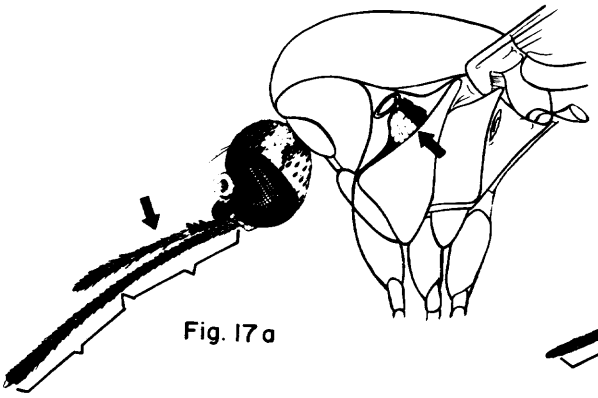


Fig. 17 a

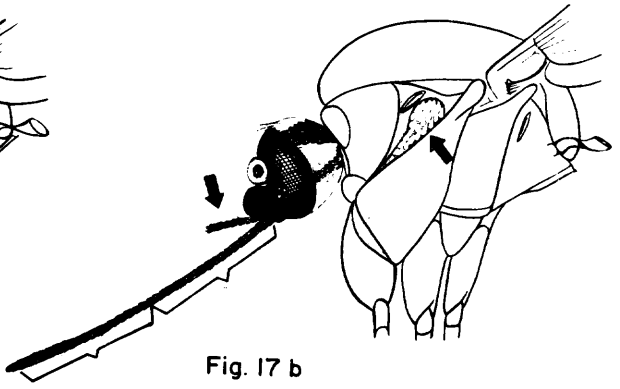


Fig. 17 b

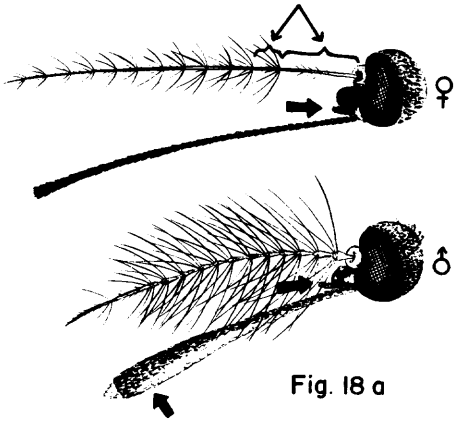


Fig. 18 a

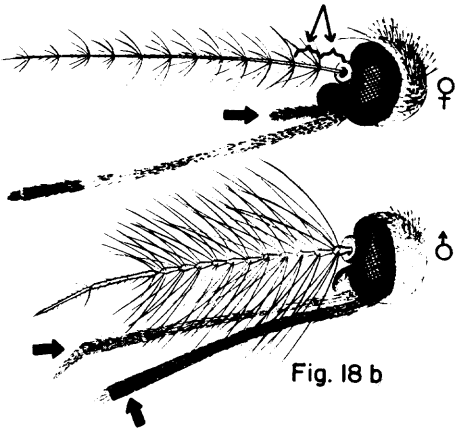


Fig. 18 b

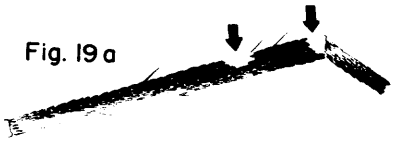


Fig. 19 a

Fig. 19 b

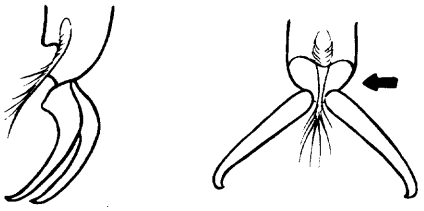


Fig. 20 a

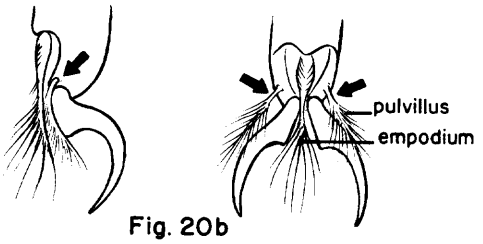


Fig. 20 b

PLATE XII

17(16). Postspiracular area with dark scales dorsally and white scales ventrally; *Female* palpus usually 0.4 to 0.7 length of proboscis (Fig. 17a) ..... *Armigeres* subgenus *Leicesteria*

Postspiracular area with white scales only; *Female* palpus less than 0.4 length of proboscis (Fig. 17b) ..... *Aedes* (in part)

18(16). *Female* antenna with flagellomere 1 approximately 3 times the length of flagellomere 2; *Male* proboscis greatly swollen on distal third or more; palpus very short, seldom longer than clypeus (Fig. 18a) ..... *Ficalbia minima*
(only single species in Thailand)

Female antenna with flagellomere 1 approximately equal length of flagellomere 2; *Male* proboscis slightly swollen apically; palpus longer than clypeus (Fig. 18b) 19

19(18). Anterior surfaces of mid and hindfemora brown with subapical and apical silver spots; abdominal terga with silver spots at middle of lateral margin (Fig. 19a).
..... *Aedes* subgenus *Ayurakitia*

Anterior surfaces of mid and hindfemora and abdominal terga without such spots (Fig. 19b) 20

20(19). Posttarsus with ungues of all legs conspicuous; pulvillus absent; abdominal terga with purple metallic scales, or wing with yellow scales (Fig. 20a) ..... *Coquillettidia*

Posttarsus with ungues of all legs inconspicuous; pulvillus very well developed at least on hindleg; abdominal terga and wing scales otherwise (Fig. 20b) ..... *Culex*

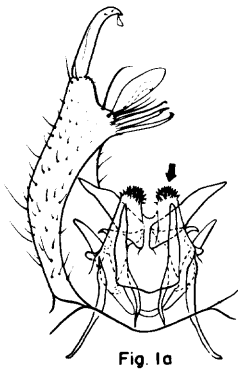


Fig. 1a

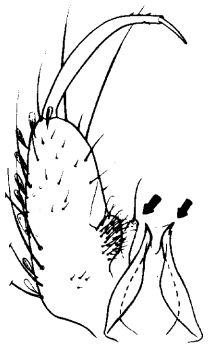


Fig. 1b

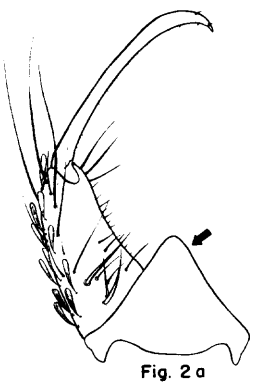


Fig. 2a

Fig. 2b

Fig. 3a

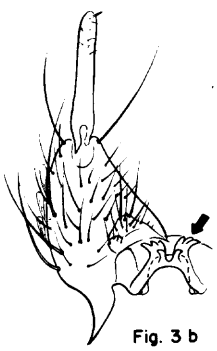


Fig. 3b

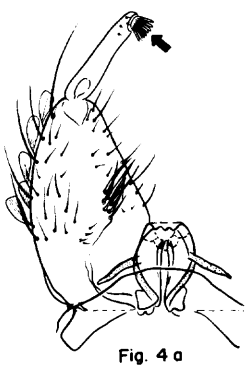


Fig. 4a

Fig. 4b

PLATE XIII

MALE GENITALIA

1. Proctiger strongly developed with many fine apical spicules; claspette absent (Fig. 1a) ..... *Culex*

   Proctiger weakly developed without spicules or with 1-3 strong apical spicules; claspette absent or present (Fig. 1b) 2

2(1). Proctiger almost completely membranous, without sclerotized paraproct (Fig. 2a) 3

   Proctiger usually with sclerotized paraproct (Fig. 2b) 6

3(2). Aedeagus tubular, finger-like, with apical leaflets, spines or filaments, less frequently simple without leaflets, spines or filaments (Fig. 3a) ..... *Anopheles*

   Aedeagus otherwise, not finger-like, without leaflets, spines or filaments (Fig. 3b) 4

4(3). Gonostylus with a comb-like process at apex (Fig. 4a) .... *Aedeomyia*

   Gonostylus without comb-like process at apex (Fig. 4b) 5

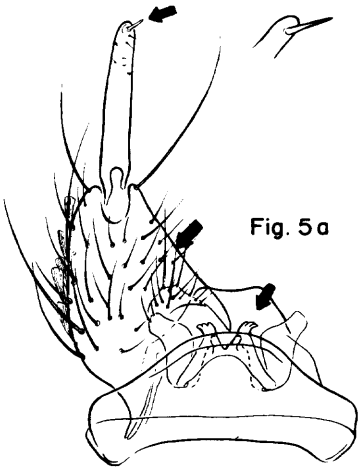


Fig. 5 a

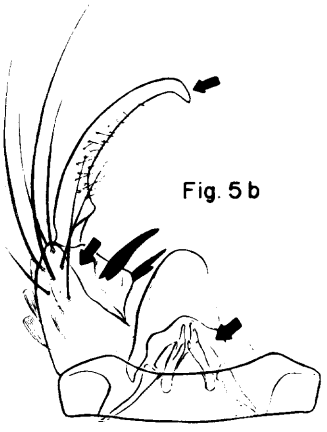


Fig. 5 b

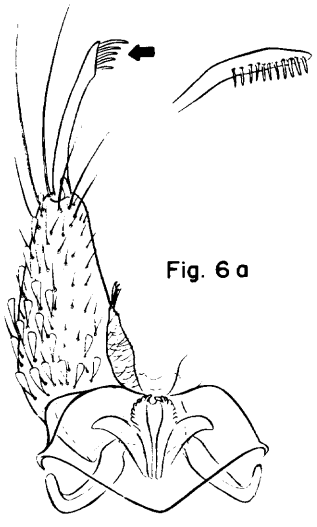


Fig. 6 a

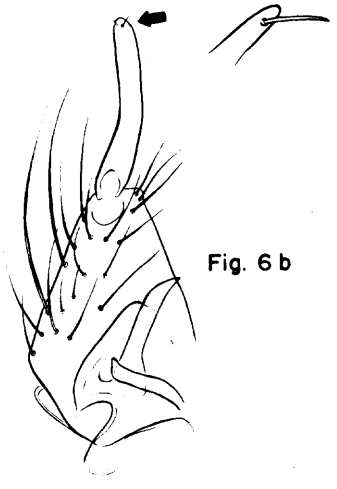


Fig. 6 b

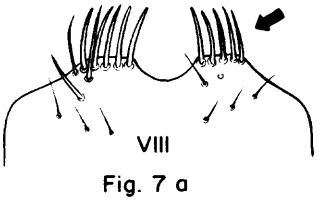


Fig. 7 a

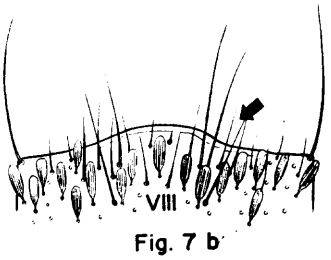


Fig. 7 b

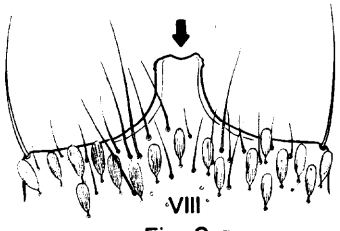


Fig. 8 a

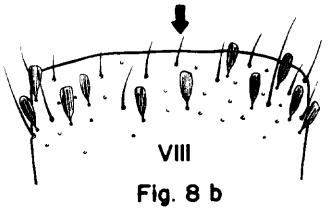


Fig. 8 b

PLATE XIV

5(4). Gonostylar claw present, or if claw absent then gonocoxite without membranous area on tergomesal surface; aedeagus consisting of pair of lateral sclerotized plates, each with varying number of apical teeth (Figs. 5a, 3b, 12b) ..... *Uranotaenia*

Gonostylar claw absent, gonocoxite with distinct membranous area on tergomesal surface; aedeagus consisting of opisthophallus, phallus and prosophallus (Figs. 5b, 10a, 12a) .... *Aedes* subgenus *Verrallina* (in part)

6(2). Gonostylus with distal comb-like process (Fig. 6a) ... *Armigeres*

Gonostylus without distal comb-like process (Fig. 6b) 7

7(6). Tergum VIII with many short, stout, submedian setae on caudal margin (Fig. 7a) ..... *Hodgesia*

Tergum VIII without short, stout, submedian setae on caudal margin (Fig. 7b) 8

8(7). Tergum VIII with distinct median lobe on caudal margin (Fig. 8a) ..... *Orthopodomyia*

Tergum VIII without distinct mediocaudal lobe (Fig. 8b) 9

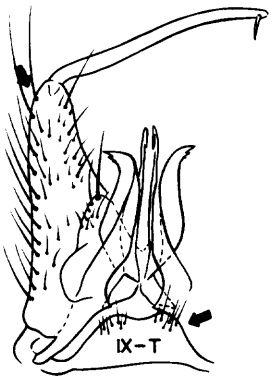


Fig. 9 a

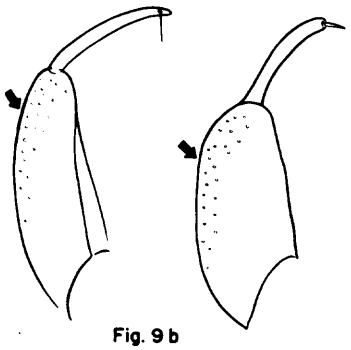


Fig. 9 b

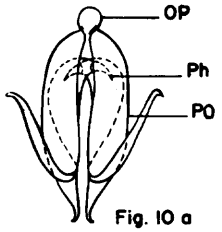


Fig. 10 a

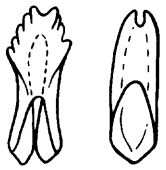


Fig. 10 b

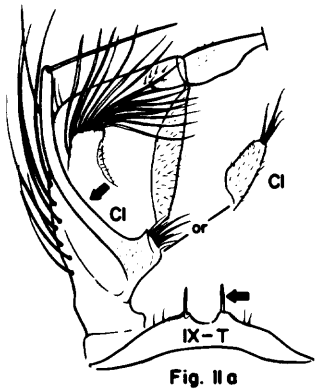


Fig. 11 a

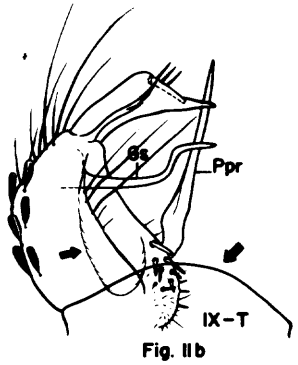


Fig. 11 b

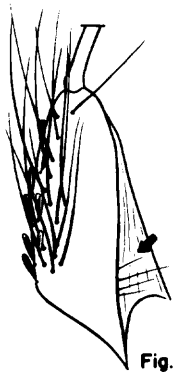


Fig. 12 a

Fig. 12 b

PLATE XV

9(8). Gonocoxite large, long, conical; tergum IX long, emarginate medially with many long setae on each side, or segment VII-VIII strongly developed with lateral marginal setae forming a conspicuous tuft; large mosquitoes (Fig. 9a) .... *Toxorhynchites*

Gonocoxite, tergum IX and segment VII-VIII otherwise; small to medium mosquitoes (Fig. 9b) 10

10(9). Aedeagus consisting of opisthophallus, phallus and prosophallus (Fig. 10a) 11

Aedeagus otherwise, not differentiated into 3 parts (Fig. 10b) 12

11(10). Tergum IX with stout or fine setae; claspette well developed (Fig. 11a) ..... *Topomyia*

Tergum IX without setae; claspette absent or poorly developed (Fig. 11b) ..... *Aedes* subgenus *Verrallina* (in part)

12(10). Gonocoxite with membranous area on tergomesal surface (Fig. 12a) 13

Gonocoxite without distinct membranous area on tergomesal surface (Fig. 12b) 16

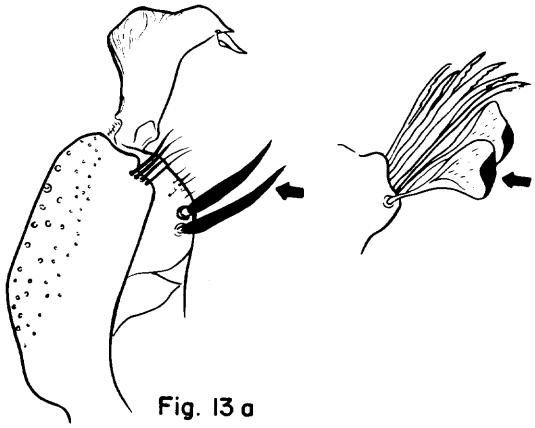


Fig. 13 a

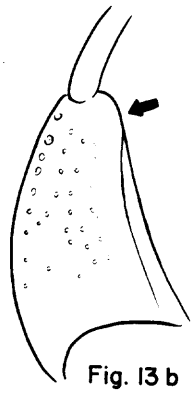


Fig. 13 b

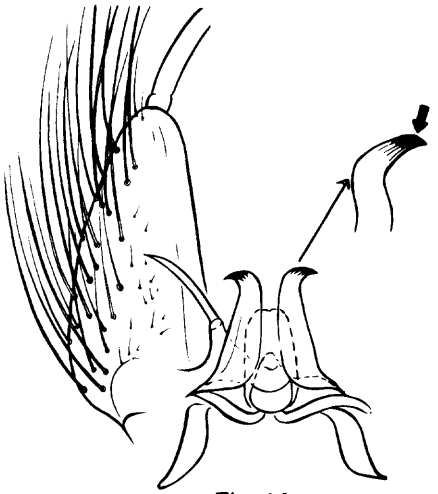


Fig. 14 a

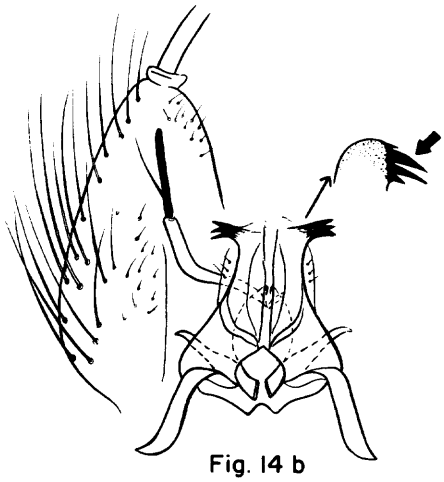


Fig. 14 b

Fig. 15 a

Fig. 15 b

PLATE XVI

13(12). Gonocoxite with subapical lobe bearing one or two strong setae, if subapical lobe not obvious then subapical leaflets and apical setae present (Fig. 13a) ..... *Heizmannia*

Gonocoxite without subapical lobe, if present not bearing strong setae or leaflets (Fig. 13b) 14

14(13). Paraproct with 1-2 apical teeth, rarely with 3 (Fig. 14a) .. .. *Aedes* (in part)
Udaya

Paraproct with at least 3 apical teeth (Fig. 14b) 15

15(14). Gonostylar claw present (Fig. 15a) ..... *Coquillettidia*

Gonostylar claw absent (Fig. 15b) ..... *Mansonia*

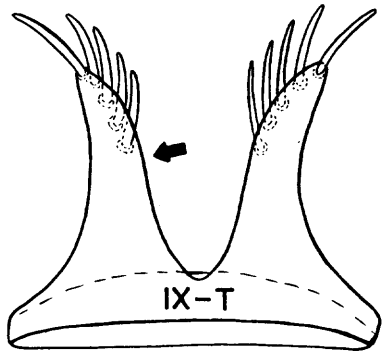


Fig. 16 a

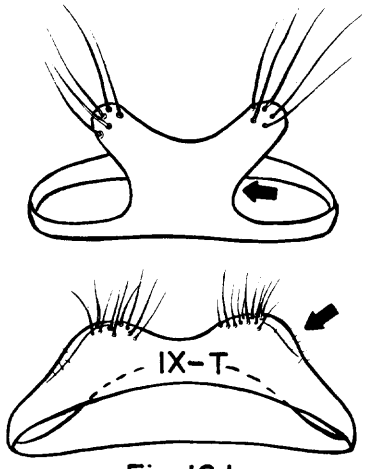


Fig. 16 b

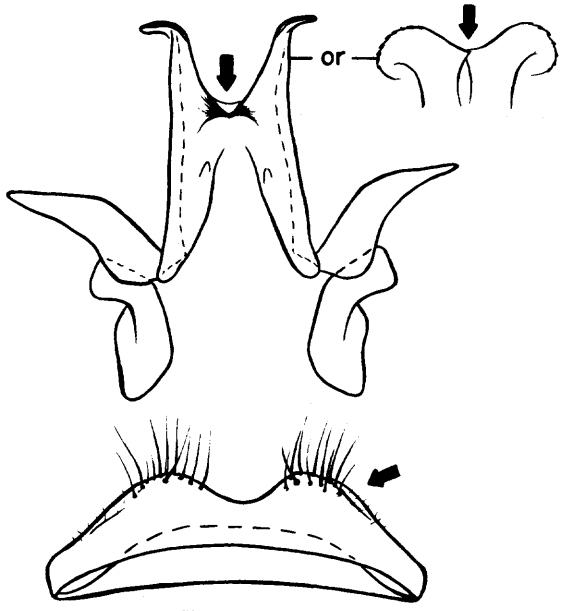


Fig. 17 a

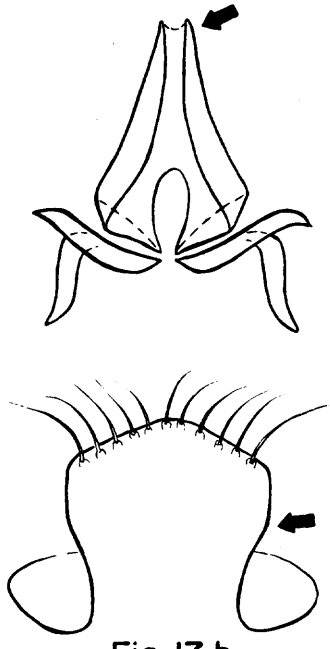


Fig. 17 b

PLATE XVII

16(12). Tergum IX with prominent pair of lobes approximately as long as tergum width at base, each lobe bearing row of stout setae apically (Fig. 16a) ..... *Tripteroides*

Tergum IX without long paired lobes from base, may have median lobe divided apically but not divided to base of lobe or more than half as long as tergum width, lobes not bearing row of stout setae apically (Fig. 16b) 17

17(16). Tergum IX with pair of submedian caudal lobes; aedeagus broad, expanded, and emarginate apically (Fig. 17a) ..... *Malaya*

Tergum IX with single median caudal lobe; aedeagus usually narrowed, if broad not emarginate apically (Fig. 17b) .....
..... *Mimomyia*
Ficalbia

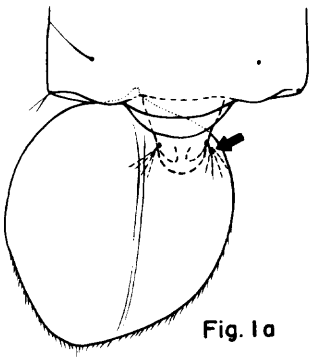


Fig. 1a

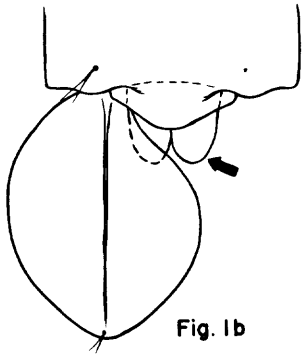


Fig. 1b

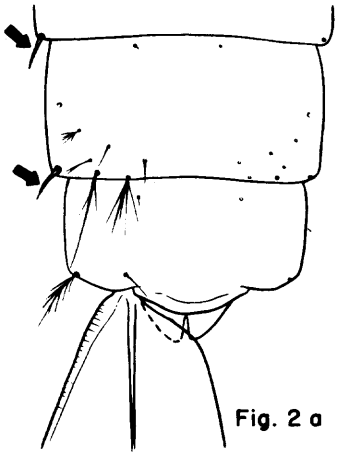


Fig. 2a

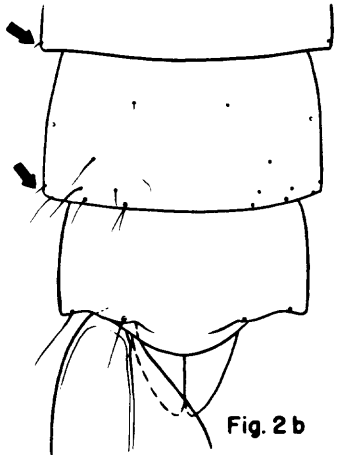


Fig. 2b

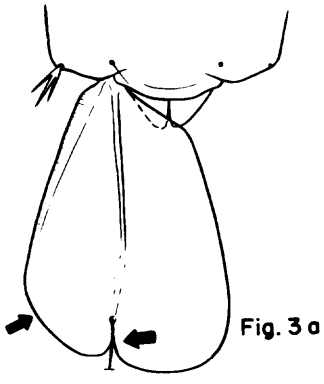


Fig. 3a

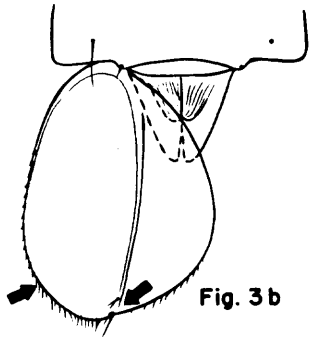


Fig. 3b

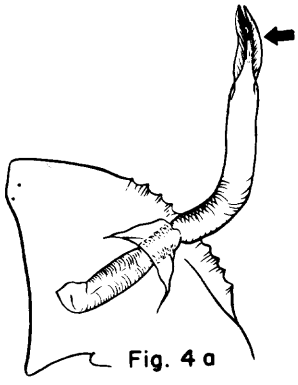


Fig. 4a

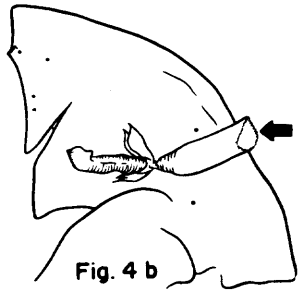


Fig. 4b

PLATE XVIII

PUPA

1. Seta 1-X present; large pupa (Fig. 1a) ..... *Toxorhynchites*

   Seta 1-X absent; small to medium pupa (Fig. 1b) 2

2(1). Seta 9-IV-VII distinct stout spine, arising at or near posterolateral corner of segment (Fig. 2a) 3

   Seta 9-IV-VII small, usually weak seta, if stout and spine-like, then not arising at or near posterolateral corner of segment (Fig. 2b) 4

3(2). Paddle smooth on both margins, deeply cleft at apex (Fig. 3a) .. .. *Aedeomyia*

   Paddle with distinct fine fringe, spicules, or teeth on at least lateral margin, not cleft at apex (Fig. 3b) ..... *Anopheles*

4(2). Trumpet modified for insertion into aquatic plant tissues (Fig. 4a) 5

   Trumpet otherwise (Fig. 4b) 7

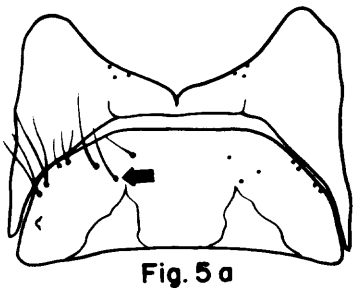


Fig. 5 a

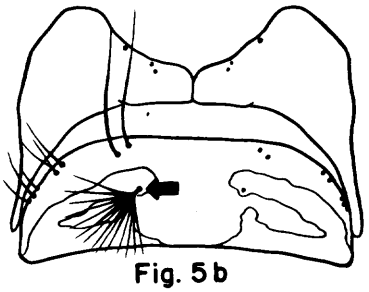


Fig. 5 b

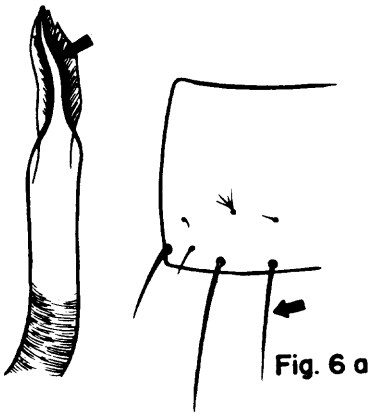


Fig. 6 a

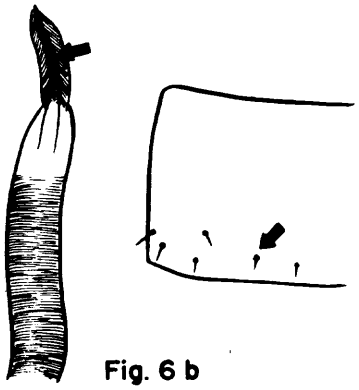


Fig. 6 b

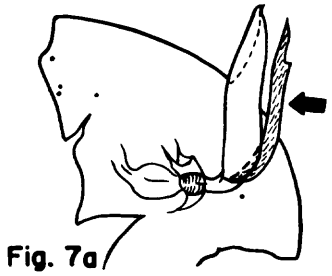


Fig. 7a

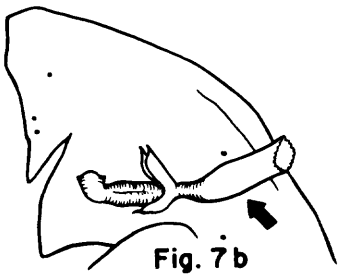


Fig. 7 b

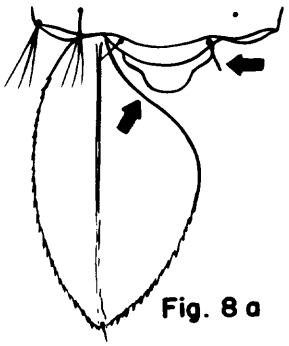


Fig. 8 a

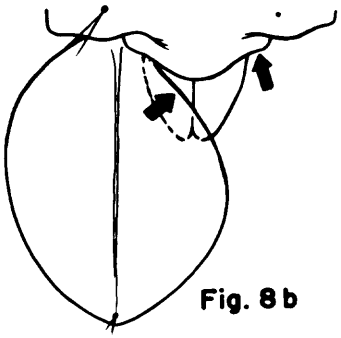


Fig. 8 b

PLATE XIX

5(4). 1-I usually single or bifid (Fig. 5a) 6

1-I usually with more than 4 branches (Fig. 5b) .. *Mimomyia* (in part)

6(5). Some abdominal setae well developed; trumpet with a strongly sclerotized spine-like process towards apex (Fig. 6a) .. *Mansonia*

All abdominal setae minute, undeveloped; trumpet with a less strongly sclerotized spine-like process towards apex (Fig. 6b) .. .. *Coquillettidia*

7(4). Trumpet with long narrow tragus from near base (Fig. 7a) .. .. *Hodgesia*

Trumpet without tragus (Fig. 7b) 8

8(7). Paddle with inner half distinctly concave towards base; 9-IX usually present (Fig. 8a) ..... *Uranotaenia*

Paddle otherwise; 9-IX absent (Fig. 8b) 9

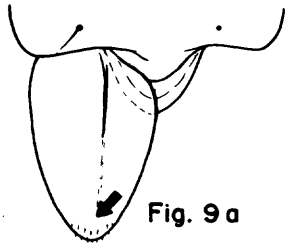
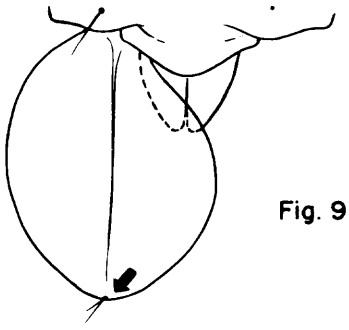


Fig. 9 a



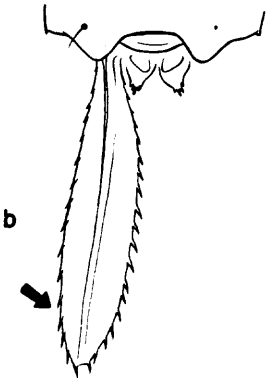


Fig. 9 b

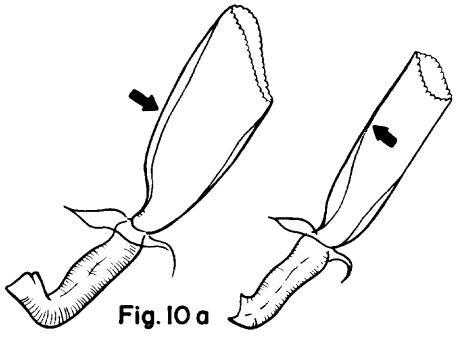


Fig. 10 a

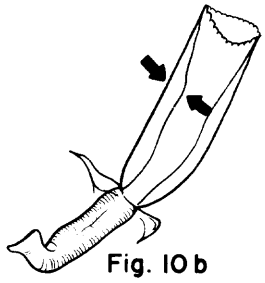


Fig. 10 b

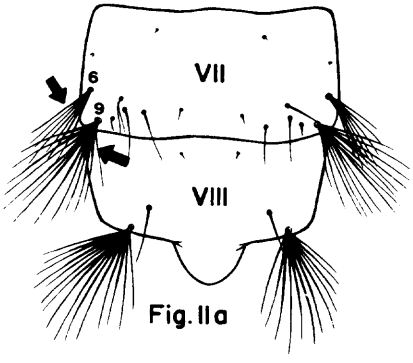


Fig. 11 a

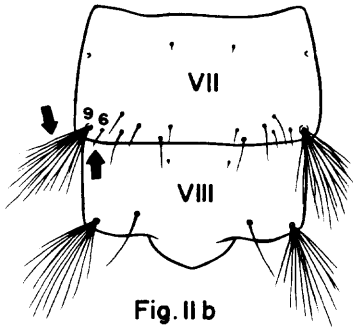


Fig. 11 b

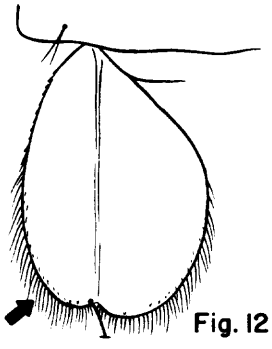


Fig. 12 a

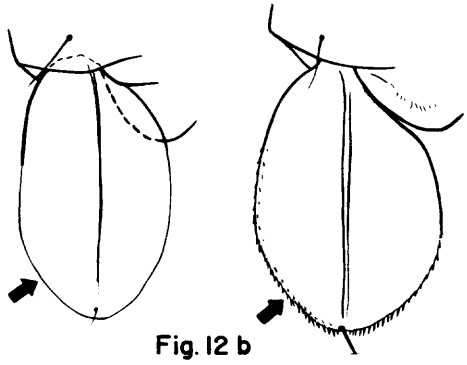


Fig. 12 b

PLATE XX

9(8). Setae 1-Pa and 2-Pa absent; paddle short, usually with pointed apex (Fig. 9a) 10

Seta 1-Pa or 2-Pa present; if absent then paddle never short and with pointed apex (Fig. 9b) 12

10(9). Trumpet subconical, if not, then inner wall touching the outer wall (Fig. 10a) ..... *Tripteroides*

Trumpet subcylindrical with inner and outer wall widely separated (Fig. 10b) 11

11(10). Seta 6-VII fairly large with many branches, arising cephalad of 9-VII (Fig. 11a) ..... *Malaya*

Seta 6-VII usually small, single or with few branches, arising close to or mesad of 9-VII (Fig. 11b) ..... *Topomyia*

12(9). Paddle margins with long delicate filamentous fringe (Fig. 12a) 13

Paddle margins smooth, with serrations or with short spicules (Fig. 12b) 16

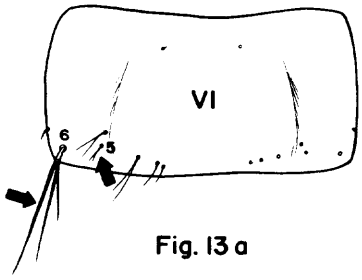


Fig. 13 a

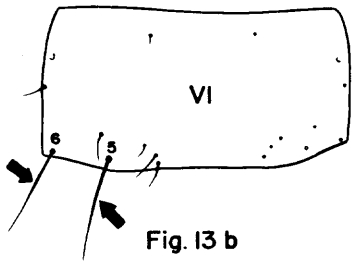


Fig. 13 b

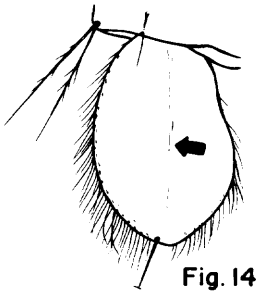


Fig. 14 a

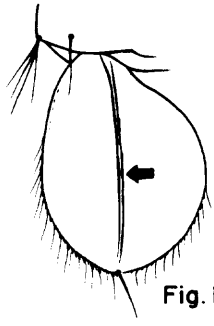


Fig. 14 b

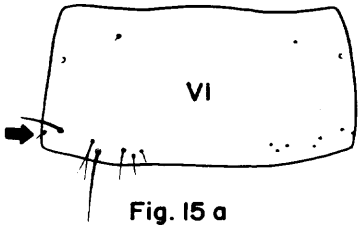


Fig. 15 a

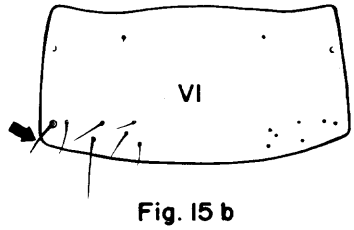


Fig. 15 b

Fig. 16 a

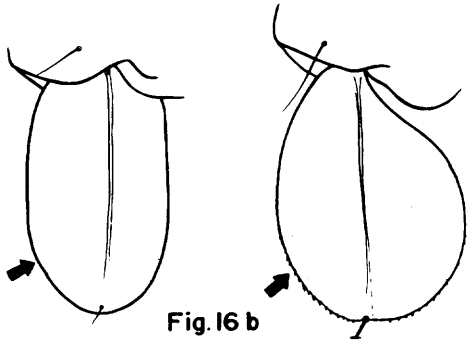


Fig. 16 b

PLATE XXI

13(12). Seta 6-VI very strongly developed, longer and much stouter than 5-VI (Fig. 13a) ..... *Armigeres*

Seta 6-VI otherwise (Fig. 13b) 14

14(13). Midrib of paddle very poorly developed (Fig. 14a) ..... *Udaya*

Midrib of paddle strongly developed (Fig. 14b) 15

15(14). Seta 9-VI usually minute, inconspicuous, much smaller than large setae on segment (Fig. 15a) ..... *Heizmannia* (in part)

Seta 9-VI otherwise, equal in size to other large setae on segment (Fig. 15b) ..... *Aedes* (in part)

Heizmannia (in part)

16(12). Paddle margins strongly serrate (Fig. 16a) 17

Paddle margins smooth or with short spicules (Fig. 16b)... 18

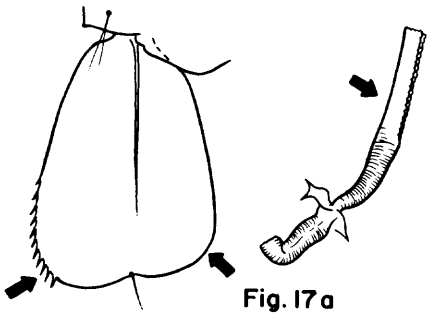


Fig. 17 a

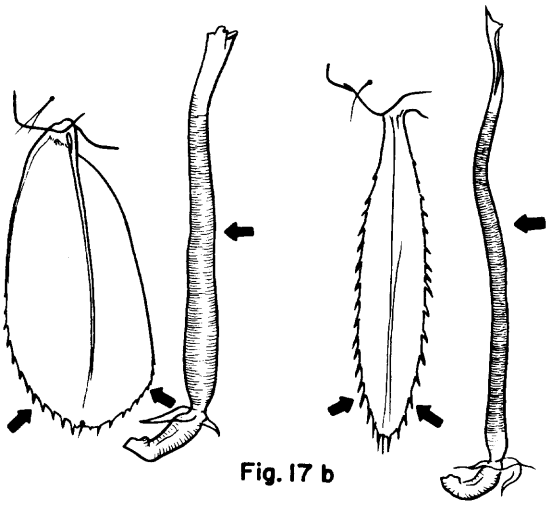


Fig. 17 b

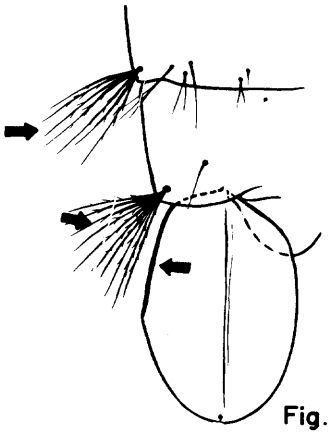


Fig. 18 a

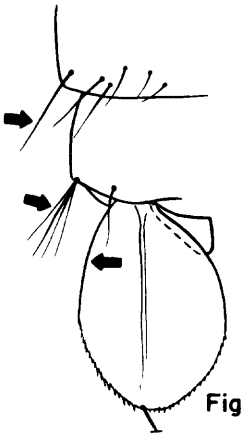


Fig. 18 b

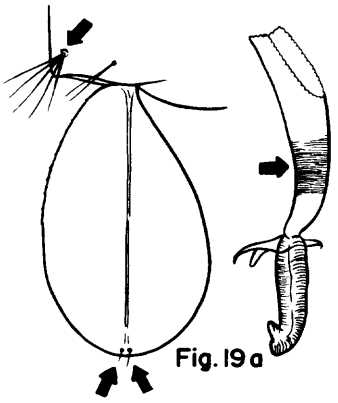


Fig. 19 a

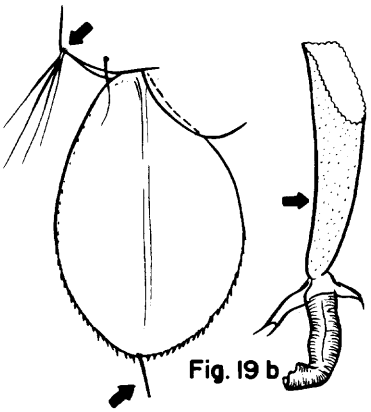


Fig. 19 b

PLATE XXII

17(16). Paddle serrate on outer margin only; trumpet short, less than 10 times as long as width (Fig. 17a) ..... *Ficalbia minima* (only single species in Thailand).

Paddle serrate on both margins; trumpet long, at least 10 times as long as width (Fig. 17b) ..... *Mimomyia* (in part).

18(16). Paddle more or less rectangular with thickened basal portion on outer margin; seta 9-VII-VIII strongly developed (Fig. 18a) ... . *Orthopodomyia**

Paddle otherwise; seta 9-VII-VIII not strongly developed (Fig. 18b) 19

19(18). Seta 9-VIII usually arising well cephalad of posterolateral corner of segment; trumpet with well developed sub-basal tracheation; paddle often with both setae 1-Pa and 2-Pa** (Fig. 19a) .. .. *Culex*

Seta 9-VIII arising at posterolateral corner of segment, rarely more cephalad; trumpet with poorly developed basal tracheation; paddle with only seta 1-Pa (Fig. 19b) ..... *Aedes* (in part).

---

* Some *Aedes* will key to here, but 9-VII not as well developed as 9-VIII, or seta 1-Pa much longer, or both.

** Absent on some *Culiciomyia*; only 2-Pa present on some *Eumelanomyia*.

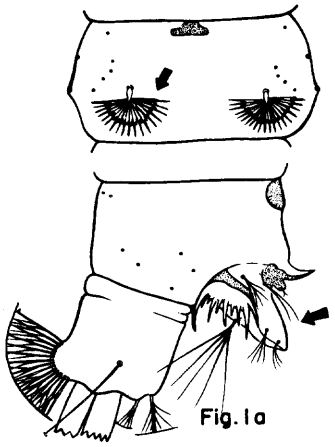


Fig. 1a

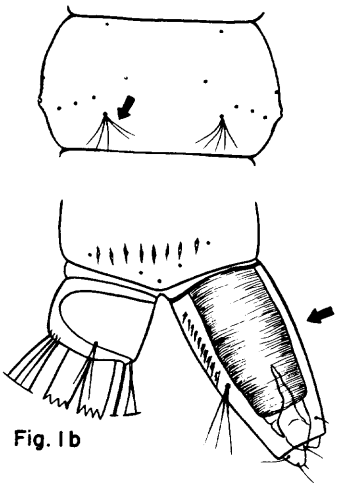
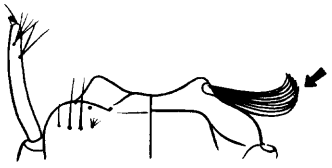
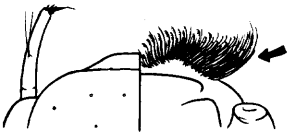


Fig. 1b





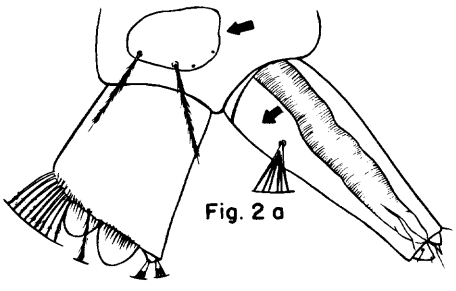


Fig. 2a

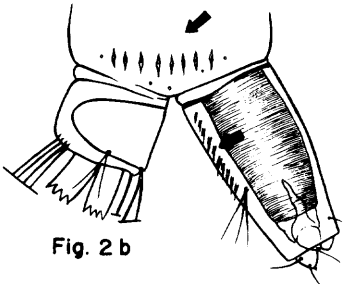


Fig. 2b

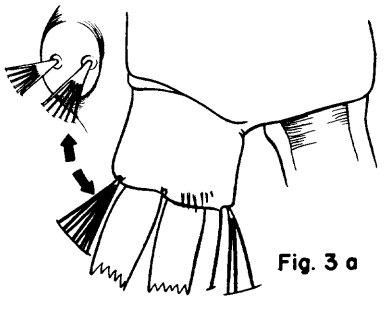


Fig. 3a

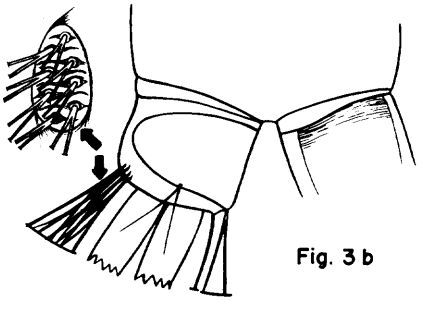


Fig. 3b

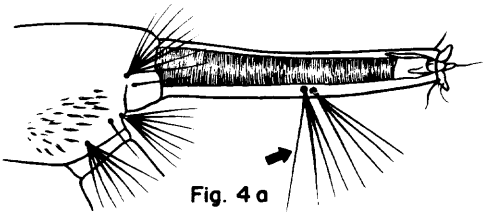


Fig. 4a

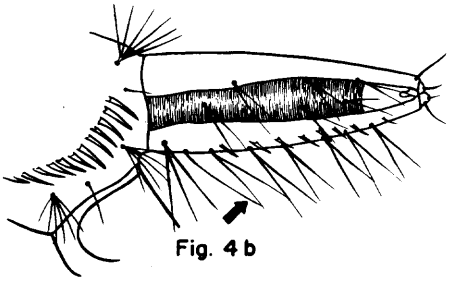


Fig. 4b

PLATE XXIII

LARVA

1. Siphon absent; abdominal seta 1 usually with well developed leaflets (palmate) on most segments (Fig. 1a) ..... *Anopheles*

   Siphon present; abdominal seta 1 never with well developed leaflets (palmate) (Fig. 1b) 2

2(1). Lateral palatal brush with 6-10 thick, simple filaments; comb scales and pecten absent (Fig. 2a) ..... *Toxorhynchites*

   Lateral palatal brush with numerous fine, simple filaments, if thick, the filament not simple; comb scales always present; pecten present or absent (Fig. 2b) 3

3(2). Seta 4-X with 1-2 pairs of setae or tufts (Fig. 3a) 4

   Seta 4-X with 4 or more pairs of setae or tufts (Fig. 3b) 7

4(3). Seta 1-S with single pair (Fig. 4a) ..*Mimomyia* subgenus *Ingramia*

   Seta 1-S with 2 or more pairs (Fig. 4b) 5

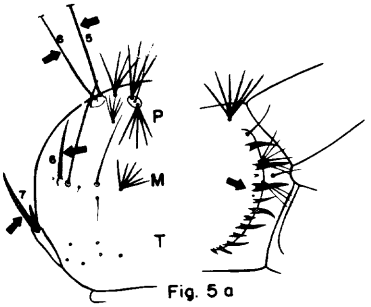


Fig. 5 a

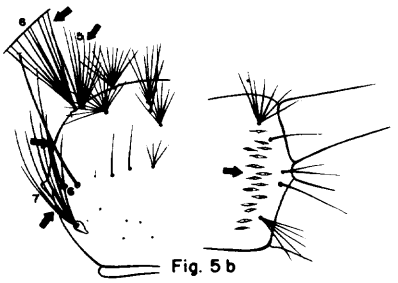


Fig. 5 b

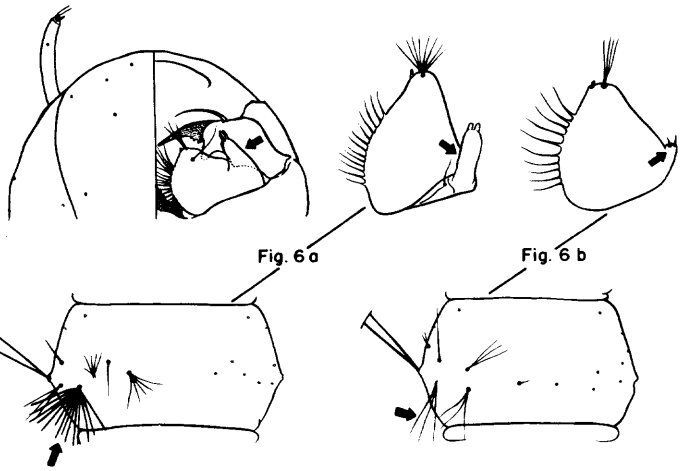
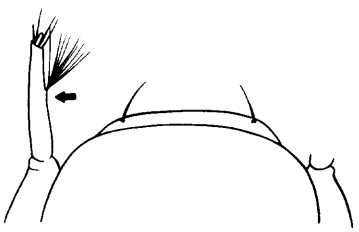


Fig. 6 a

Fig. 6 b



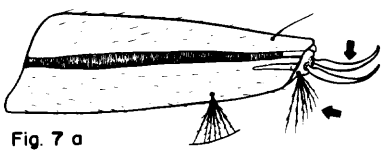


Fig. 7 a

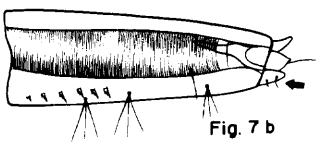


Fig. 7 b

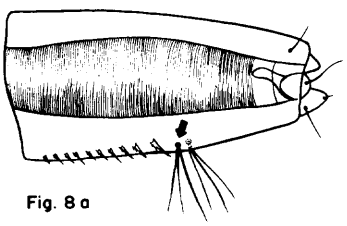


Fig. 8 a

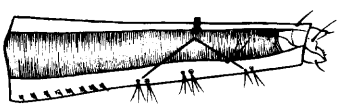


Fig. 8 b

PLATE XXIV

5(4). Seta 5 or 6-P usually single; seta 6-M or 7-T often stout or spine-like; thorax and abdomen with heavily stellate setae; comb scales usually in a single row (Fig. 5a) ..... *Tripteroides*

Setae 5 and 6-P fairly large, fan shaped; setae 6-M and 7-T never stout or spine-like; thorax and abdomen without heavily stellate setae; comb scales usually in 2 or more rows (Fig. 5b) 6

6(5). Maxillary palpus well developed, or abdominal segments IV-VI with 1 or more pairs of stellate setae (Fig. 6a) .... *Topomyia*

Maxillary palpus undeveloped; abdominal segments IV-VI never with stellate setae (Fig. 6b) ..... *Malaya*

7(3). Antenna enlarged, markedly curved and flattened; siphon with paired hooks and branched setae at tip (Fig. 7a) ..... *Aedeomyia*

Antenna and siphon otherwise (Fig. 7b) 8

8(7). Seta 1-S with single pair (Fig. 8a) 9

Seta 1-S with 3 or more pairs (Fig. 8b) ..... *Culex*

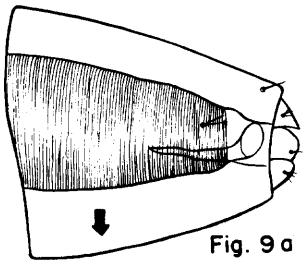


Fig. 9 a

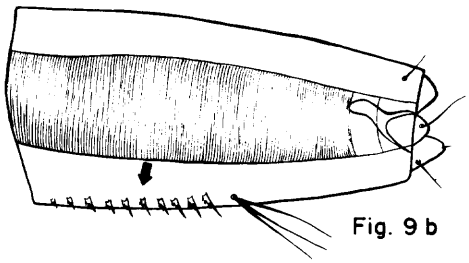


Fig. 9 b

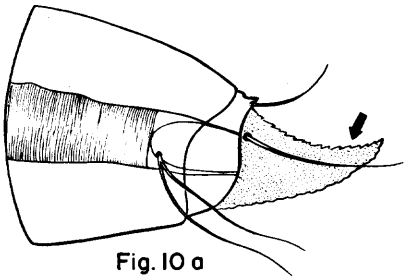


Fig. 10 a

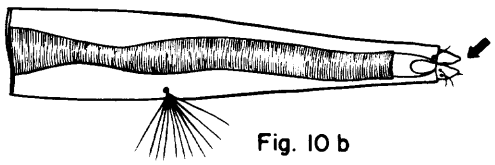


Fig. 10 b

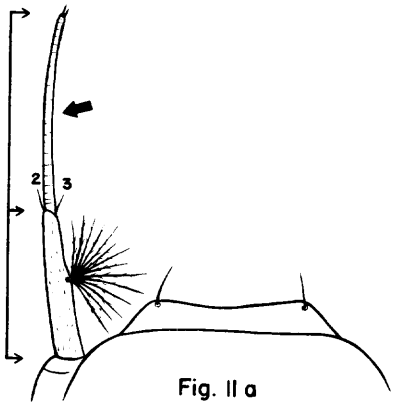


Fig. 11 a

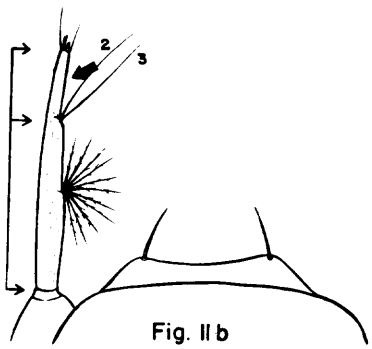


Fig. 11 b

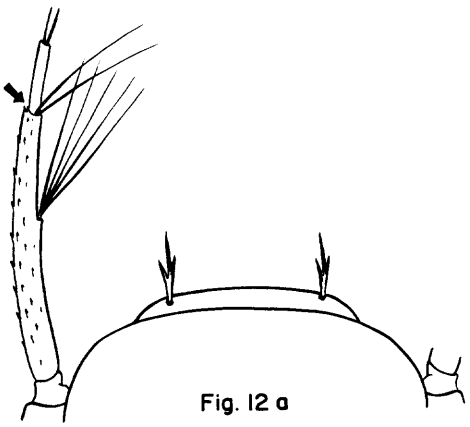


Fig. 12 a

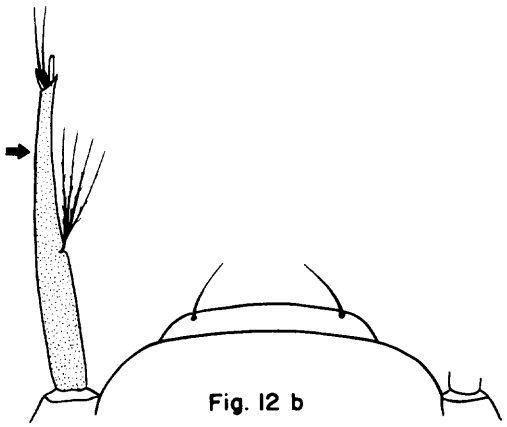


Fig. 12 b

PLATE XXV

9(8). Siphon without pecten (Fig. 9a) 10

Siphon with pecten (Fig. 9b) 14

10(9). Siphon with sclerotized saw-toothed process at tip, modified for piercing plant tissues (Fig. 10a) 11

Siphon without saw-toothed process at tip (Fig. 10b) 12

11(10). Antenna with part distal to setae 2, 3-A flexible, as long as or longer than the proximal part (Fig. 11a)..... *Coquillettidia*

Antenna with part distal to setae 2, 3-A not flexible, less than 0.5 as long as the proximal part (Fig. 11b)..... *Mansonia*

12(10). Distal portion of antenna with joint, apical part freely movable (Fig. 12a) ..... *Mimomyia* subgenus *Etorleptiomyia*

Distal portion of antenna otherwise (Fig. 12b) 13

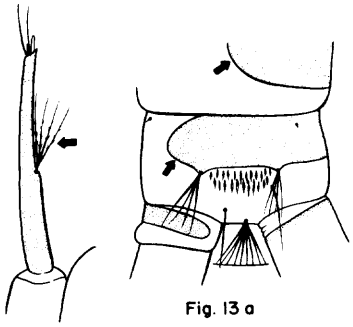


Fig. 13 a

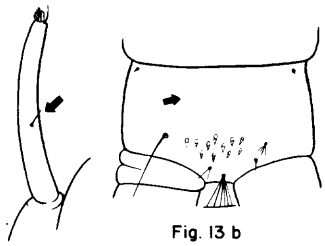


Fig. 13 b

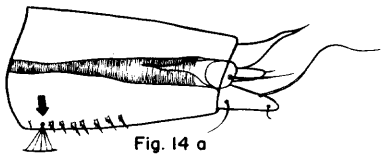


Fig. 14 a

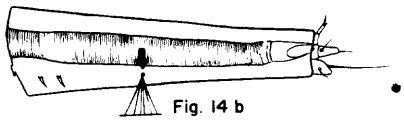


Fig. 14 b

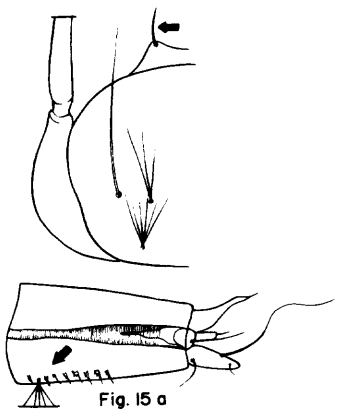


Fig. 15 a

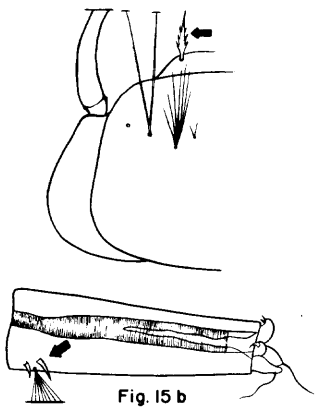


Fig. 15 b

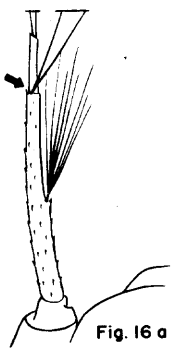


Fig. 16 a

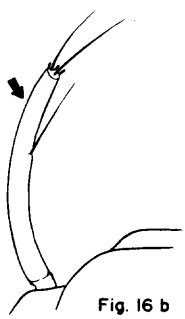


Fig. 16 b

PLATE XXVI

13(12). Seta 1-A rather large with 4 or more branches; abdominal segments VII and VIII with large sclerotized plates (Fig. 13a) ..... *Orthopodomyia*

Seta 1-A minute, usually single or bifid; abdominal segments VII and VIII without sclerotized plates (Fig. 13b) ..... *Armigeres*

14(9). Seta 1-S arising near base of siphon (Fig. 14a) 15

Seta 1-S arising beyond basal 0.33 of siphon (Fig. 14b) 16

15(14). Seta 1-C simple; pecten with at least 3 teeth, usually more (Fig. 15a) ..... *Hodgesia*

Seta 1-C strongly barbed; pecten with at most 2 teeth (Fig. 15b) ..... *Ficalbia minima*

(only single species in Thailand)

16(14). Distal portion of antenna with joint, apical part freely movable (Fig. 16a) ..... *Mimomyia* subgenus *Mimomyia*

Distal portion of antenna otherwise (Fig. 16b) 17

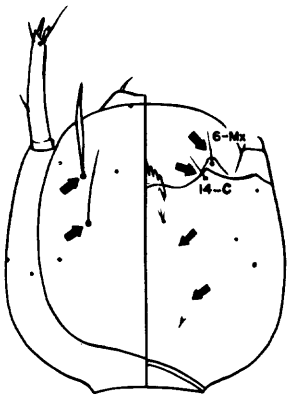
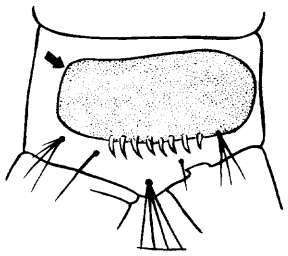


Fig. 17 a



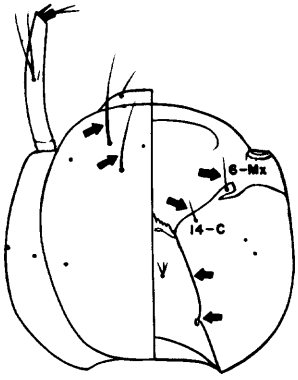
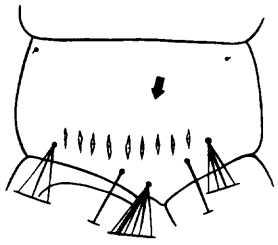


Fig. 17 b



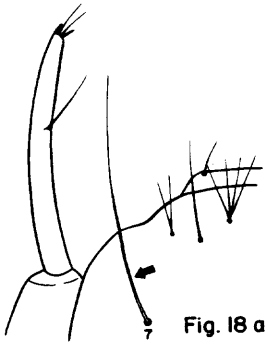


Fig. 18 a

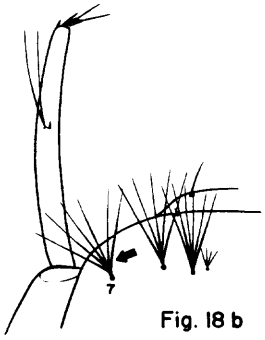


Fig. 18 b

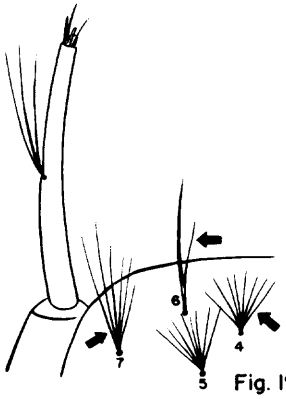


Fig. 19 a

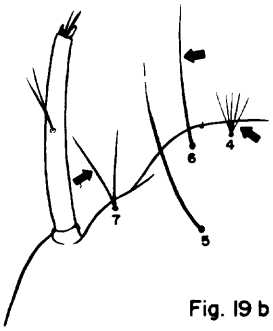


Fig. 19 b

PLATE XXVII

17(16). Venter of head with hypostomal suture absent or incomplete, not reaching posterior tentorial pit; seta 5 and/or 6-C stout and spine-like in some species; seta 14-C close to seta 6-Mx; abdominal segment VIII with a sclerotized plate (Fig. 17a) ... *Uranotaenia*

Venter of head with hypostomal suture well developed, extending from level of mentum to posterior tentorial pit; setae 5 and 6-C never stout and spine-like; seta 14-C widely separated from seta 6-Mx; abdominal segment VIII without sclerotized plate (present in some species of *Aedes* subgenus *Stegomyia*) (Fig. 17b) .. 18

18(17). Seta 7-C single, much longer than 5 and 6-C; comb with at most 10 scales in a single row (Fig. 18a) ..... *Udaya*

Seta 7-C with 2 or more branches, if single, not longer than 5 and 6-C; comb scales variable (Fig. 18b) 19

19(18). Setae 4 and 7-C large, conspicuous with many branches, and 6-C usually single or with 2 unequal branches; comb with not more than 20 scales or spines (Fig. 19a) ..... *Heizmannia*

Setae 4 and 7-C usually small with few branches, if large, with many branches, then 6-C never with 2 unequal branches; comb scales variable (Fig. 19b) ..... *Aedes*

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